PROJECT MANUAL FOR

TARWATER VETERINARY CLINIC
NEW CONSTRUCTION
802 E. CRINER ST.
GRANDVIEW, TX 76050

Project No. 1744-22
September 26, 2024

BID SET

09/26/24

MAGEE ARCHITECTS, L.P.
FORT WORTH, TEXAS

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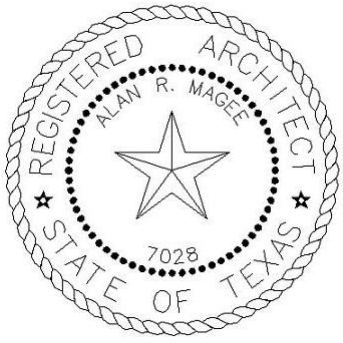

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❖ **PLEASE NOTE – REFER TO SEPARATE CONSTRUCTION SET OF DRAWINGS & SPECIFICATIONS FOR ALL CIVIL & LANDSCAPING CRITERIA, UNDER SEPARATE COVER.**

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SECTION 00 1010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of Contract, this Section and other sections of Division 1 - General Requirements and Drawings apply to entire Work of Contract.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract comprises construction of:
   1. New Construction of a Veterinary Clinic Building to include space for treatment rooms, offices, consultant rooms, restrooms, mechanical rooms, and storage and support areas. New Veterinary Clinic Building is to be 4,856 sf on an 18.878 sf (1/2 Acre) Building Site Plan with twenty-five (25) Parking Spaces.
   2. New Sitework and Landscaping for exterior areas.

B. Work consists of providing labor, materials, equipment, services, and administration required in conjunction with or properly incidental to Project construction.

1.03 WORK SEQUENCE

A. Sequencing of Construction Plan: Before start of construction on site, submit three copies of construction plan regarding phasing of site demolition and construction, and new building construction for acceptance by Architect/Engineer. After acceptance of plan, construction sequencing shall comply with accepted plan unless deviations are accepted in writing.

1.04 CONTRACTOR USE OF PREMISES

A. Limit use of premises for Work, storage, and access to allow:
   1. Access by Owner, Architect and Engineers.
   2. Work by other contractors.

B. Coordinate use of premises with Architect.

C. Protect and provide safekeeping of products stored on site under this Contract.

D. Move stored products which interfere with operations of separate contractors.

E. Conduct operations to ensure least inconvenience to adjacent properties.
   1. Noisy and Disruptive Operations (such as use of jack hammers, hammer drills, floor removal tools, and other noisy equipment): Not allowed in close proximity to adjacent properties during regular hours of operation. Coordinate and schedule such operations with Architect and Code Compliance to minimize disruptions.
   2. Power Outages: Coordinate and schedule electrical and other utility outages with Utility Providers. Outages: Allowed only at previously agreed upon times. In general, schedule outages at times that will be minimal to adjacent properties.

F. Obtain and pay for use of additional storage or staging areas needed for operations.

G. Obtain approval and pay for use of portions of existing streets, sidewalks or rights of way for operations in accordance with requirements of authorities having jurisdiction.

H. Construction Plan: Before start of construction on site, submit three copies of construction plan regarding access to work, use of site, and utility outages to Architect for acceptance. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted in writing.

1.05 OWNER FURNISHED/OWNER INSTALLED PRODUCTS

A. Contractor shall cooperate with Owner as required in granting access to the job site, and to the scheduling of the Owner's workers or contractors for the purpose of installing Owner furnished products.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

DOCUMENT 00 1113
ADVERTISEMENT FOR BIDS

TARWATER VETERINARY CLINIC

ADVERTISEMENT FOR BIDS

Sealed bids will be received at the offices of Tarwater Veterinary Services, PLLC (White Oak Veterinary Clinic), 9221 County Road 105, Grandview, Texas 76050, until OCTOBER 31ST, 2024, at 2:00 PM, and publicly opened and read at that time for the construction of the following:

TARWATER VETERINARY CLINIC – NEW CONSTRUCTION

There will be a pre-bid meeting held on THURSDAY, OCTOBER 17TH, at 10:00 a.m. at the Project Site, 802 E. CRINER ST., GRANDVIEW, TX 76050

Further information and specifications may be obtained at iSqFt Construction Connect Co., or from Magee Architects, L.P. at 817-615-9558 or 817-992-1877.

The Owner reserves the right to reject any or all bids and to waive formalities.

DOCUMENT 00 1116
INVITATION FOR BID

1.01 GENERAL

A. Selected General Contractors are invited to submit a bid for the New Construction for the Tarwater Veterinary Clinic at 802 E. Criner St., Grandview, TX 76050.

B. Bids must be on a Lump Sum AIA Contract.

C. The Owner will receive sealed Bids until 2:00 p.m., local time, 31st day, October 2024 at the offices of Dr. Christopher Tarwater at White Oak Veterinary Clinic, 9221 County Road 105, Grandview, Texas 76050 .

D. Bids will be opened privately immediately after the time set for submittal.

E. Bidders are required to state the number of days required to achieve substantial completion of the Work.

F. A Bid Security in the amount of five percent of the highest possible bid amount is required.

G. Bids are required to be submitted under a condition of irrevocability for a period of 30 days after submittal.

H. Submit bids on the Bid Form provided.

1.02 EXAMINATION OF SITE

A. There will be a pre-bid meeting held on THURSDAY, OCTOBER 17TH, at 10:00 a.m. at the Project Site, 802 E. CRINER ST., GRANDVIEW, TX 76050. Prospective Bidders are encouraged to attend, but not required. Subcontractors are not required, but allowable.

DOCUMENT 00 2113
INSTRUCTION TO BIDDERS

1.01 DOCUMENT

A. American Institute of Architects Document A701-2018, Instructions to Bidders, forms a part of the Bidding Documents and by reference is incorporated herein with the following supplements.

1.02 SUPPLEMENTS

A. The following supplements modify, delete from, or add to the Instructions to Bidders referenced above.

B. Where provisions of the Instructions to Bidders are modified, unaltered provisions remain in effect.

C. Article 3 - Bidding Documents:

1. Delete Subparagraph 3.3.2; substitute the following:

   3.3.2 Substitutions will not be considered prior to award of Contract. Refer to Section 01 2500 - Substitution Procedures for additional information.

2. Delete Subparagraphs 3.3.3 and 3.3.4.

3. In Subparagraph 3.2.2, change “seven days” to read “three days.”

D. Article 4 - Bidding Procedures:

1. Add Subparagraph 4.1.9:

   4.1.9 Identify the time of completion on the bid form. The date of substantial completion in the Owner/Contractor Agreement shall be the time of completion added to the commencement date.

2. Delete the first sentence of Subparagraph 4.2.1; substitute the following:

   4.2.1 Each bid shall be accompanied by a bid security in an amount equal to 5 percent of the maximum possible bid amount, consisting of either a certified check or a surety bond, pledging that the bidder will enter into a contract with the Owner on the terms stated in the bid and will furnish bonds covering the faithful performance of the contract and payment of obligations arising thereunder.

3. Delete Subparagraph 4.2.2; substitute the following:

   4.2.2 If a surety bond is submitted, it shall be issued by a surety licensed to conduct business in the State in which the project is located, and shall be written on form included herein.

E. Article 5 - Consideration of Bids:

1. Add the following to Subparagraph 5.2.1:

   5.2.1 The Owner shall have the right to disqualify any bidder who fails to satisfy the Owner that he is qualified to complete the Work.

2. Add Subparagraph 5.3.3:

   5.3.3 The Owner requires that work of this contract be completed as quickly as possible.

END OF SECTION

DRAFT

AIA® Document A701™ – 2018

Instructions to Bidders

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

Tarwater Veterinary Clinic
802 E. Criner St
Grandview, Texas 76050

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

Chris Tarwater DVM
802 E. Criner St
Grandview, Texas 76050

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

Magee Architects, L.P.
PO Box 101445
Fort Worth, Texas 76185

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 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
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

« »

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper

documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to 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.)

« »

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 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.

§ 3.4.4 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 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 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.

§ 4.1.8 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.)

« »

§ 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« »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.)

« »

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

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

§ 4.3.5 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.)

« »

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids
Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)
§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION
§ 6.1 Contractor's Qualification Statement
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability
A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals
§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND
§ 7.1 Bond Requirements
§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 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.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

« »

§ 7.2 Time of Delivery and Form of Bonds
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

« »

DOCUMENT 00 2513

PREBID MEETINGS

PART 1 GENERAL

1.01 PREBID MEETING

A. Owner will conduct a Prebid meeting as indicated below:
   1. Meeting Date: **Thursday, the 17th day of October 2024**
   2. Meeting Time: **10:00 to 11:00am, CDT**
   3. Location: **802 E. CRINER ST.**
      GRANDVIEW, TX 76050

B. Attendance:
   1. Bidding Contractor: Attendance at Prebid meeting is encouraged, but not required.
   2. Subcontractors: Attendance at Prebid meeting is not required, but allowable.

C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two (2) business days prior to meeting.

D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
   1. Procurement and Contracting Requirements:
      a. Invitation to Bid.
      b. Instructions to Bidders.
      c. Bidder Qualifications.
      d. Bonding.
      e. Insurance.
      f. Bid Security.
      g. Bid Form and Attachments.
      h. Bid Submittal Requirements.
      i. Notice of Award.
   2. Communication during Bidding Period:
      a. Obtaining documents.
      b. Bidder's Requests for Information.
      c. Bidder's Substitution Request/Prior Approval Request.
      d. Addenda.
   3. Contracting Requirements:
      a. Agreement.
      b. The General Conditions.
      c. Other Owner requirements.
   4. Construction Documents:
      a. Scopes of Work.
      b. Temporary Facilities.
      c. Use of Site.
      d. Work Restrictions.
      e. Substitutions following award.

5. Separate Contracts:
   a. Work by Owner.
   b. Work of Other Contracts.
6. Schedule:
   a. Project Schedule.
   b. Contract Time.
   c. Liquidated Damages.
   d. Other Bidder Questions.
7. Any clarifications required to the bid documents arising from this Pre-Bid Meeting will be issued in subsequent addenda.

E. Bidder Sign in Sheet: The Prebid sign in sheet will be made available within two (2) business days following the meeting to all bidders via the bid posting location provided by the Owner and Architect.

END OF SECTION

DOCUMENT 00 3132

GEOTECHNICAL DATA

PART 1 GENERAL

1.01 DESCRIPTION

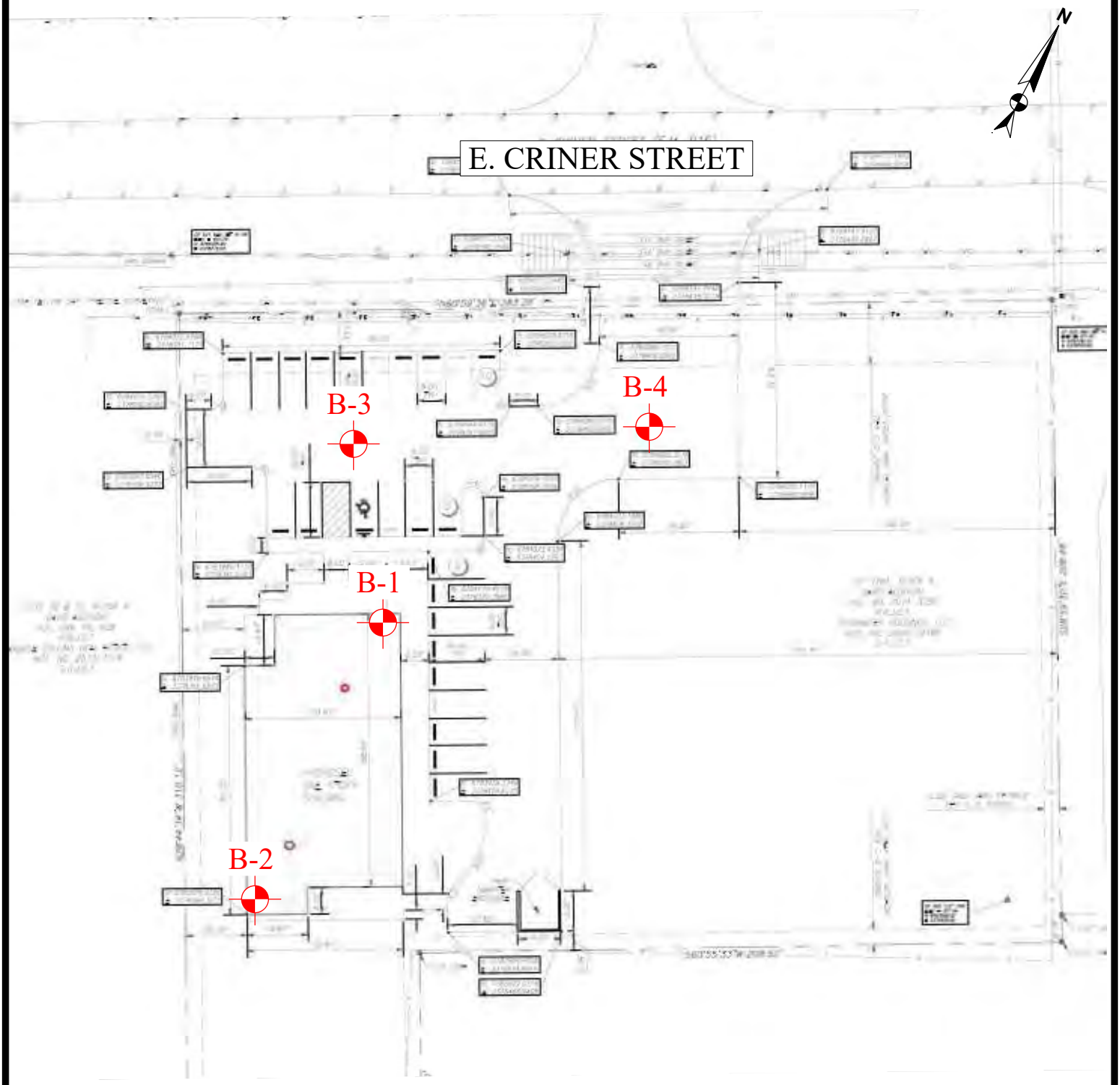
A. Soil investigation report has been prepared by American Geotechnical & Civil Consulting, Inc, referred to as the soils engineer.

B. A copy of the locations and log of borings is bound herein. A copy of the complete report may be inspected at the office of the Architect.

C. This report was obtained only for use by Architect/Engineer in design and is not a part of the contract documents.

D. Report and log of borings are made available for Contractor's information, but are not a warranty of subsurface conditions.

E. Additional Investigation: Contractor should visit the site and acquaint himself with the site conditions.



GEOTECHNICAL EXPLORATION REPORT
GRANDVIEW TEXAS VETERINARIAN CLINIC
802 EAST CRINER STREET
GRANDVIEW, TEXAS
UES PROJECT NO. W242089

UES™
Formerly Alpha Testing

FIGURE 1

BORING LOCATION PLAN

APPROXIMATE BORING LOCATION

UES
Formerly Alpha Testing

5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 1
Sheet 1 of 1

PROJECT NO.: W242089

Client: Magee Architects
Project: Grandview Texas Veterinarian Clinic
Start Date: 7/29/2024 **End Date:** 7/29/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Grandview, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 15
▼ After Drilling (ft): 15
▽▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Dark Brown CLAY with calcareous nodules				3.75					21				
						4.5					18	70	24	46	
		4.0													
5		Brown CLAY with calcareous nodules				4.5					20				
		6.0													
		Light Brown CLAY with calcareous nodules				2.75					23				
						2.25					24	62	21	41	0.0
10		10.0													
		Tan and Gray CLAY													
						3.0					27				
15	▼	15.0													
		Tan and Gray SHALY CLAY				3.0	1.5			98	19				
20															
		23.0													
		Gray SHALY CLAY with shale seams and layers				4.5+					29				
25		25.0													
		TEST BORING TERMINATED AT 25 FT													

UES
Formerly Alpha Testing

5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 2
Sheet 1 of 1

PROJECT NO.: W242089

Client: Magee Architects
Project: Grandview Texas Veterinarian Clinic
Start Date: 7/29/2024 **End Date:** 7/29/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Grandview, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Dark Brown CLAY				3.5					21				
		2.0													
		Brown CLAY with calcareous nodules				2.25					25	61	20	41	
		4.0													
5		Light Brown CLAY with calcareous nodules				4.25					19				
						2.0					21				
		8.0													
		Brown CLAY with calcareous nodules				2.5					20				
10		10.0													
		Tan CLAY				4.5+	2.2			94	26	79	26	53	
15		15.0													
		Tan and Gray CLAY with shale				4.5+	2.0			91	26				
20		23.0													
		Gray SHALY CLAY				4.5+					17				
		24.0													
		Gray SHALE			100/ 2.50"										
25		25.0													
		TEST BORING TERMINATED AT 25 FT													

UES
Formerly Alpha Testing

5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 3
Sheet 1 of 1

PROJECT NO.: W242089

Client: Magee Architects
Project: Grandview Texas Veterinarian Clinic
Start Date: 7/29/2024 **End Date:** 7/29/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Grandview, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Dark Brown CLAY with calcareous nodules				3.0					23				
		2.0													
		Brown CLAY with calcareous nodules				4.5+					20	70	24	46	
5		5.0				3.0					22				
		TEST BORING TERMINATED AT 5 FT													
10															
15															
20															
25															

UES
Formerly Alpha Testing

5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 4
Sheet 1 of 1

PROJECT NO.: W242089

Client: Magee Architects
Project: Grandview Texas Veterinarian Clinic
Start Date: 7/29/2024 **End Date:** 7/29/2024
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Grandview, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

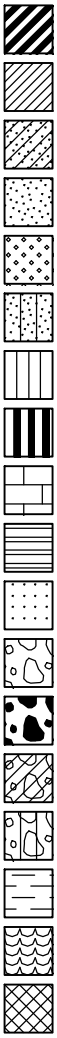
GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Dark Brown CLAY with calcareous nodules				2.5					25	63	21	42	
		2.0													
		Brown CLAY with calcareous nodules				2.0					22				
		4.0													
5		Light Brown CLAY with calcareous nodules				1.5					22				
		5.0													
		TEST BORING TERMINATED AT 5 FT													
10															
15															
20															
25															

Formerly Alpha Testing

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

SOIL & ROCK SYMBOLS



(CH), High Plasticity CLAY
(CL), Low Plasticity CLAY
(SC), CLAYEY SAND
(SP), Poorly Graded SAND
(SW), Well Graded SAND
(SM), SILTY SAND
(ML), SILT
(MH), Elastic SILT
LIMESTONE
SHALE / MARL
SANDSTONE
(GP), Poorly Graded GRAVEL
(GW), Well Graded GRAVEL
(GC), CLAYEY GRAVEL
(GM), SILTY GRAVEL
(OL), ORGANIC SILT
(OH), ORGANIC CLAY
FILL

SAMPLING SYMBOLS

SHELBY TUBE (3" OD except where noted otherwise)
SPLIT SPOON (2" OD except where noted otherwise)
AUGER SAMPLE
TEXAS CONE PENETRATION
ROCK CORE (2" ID except where noted otherwise)

RELATIVE DENSITY OF COHESIONLESS SOILS (blows/ft)

VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

SHEAR STRENGTH OF COHESIVE SOILS (tsf)

VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
FIRM	0.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

RELATIVE DEGREE OF PLASTICITY (PI)

LOW	4 TO 15
MEDIUM	16 TO 25
HIGH	26 TO 35
VERY HIGH	OVER 35

RELATIVE PROPORTIONS (%)

TRACE	1 TO 10
LITTLE	11 TO 20
SOME	21 TO 35
AND	36 TO 50

PARTICLE SIZE IDENTIFICATION (DIAMETER)

BOULDERS	8.0" OR LARGER
COBBLES	3.0" TO 8.0"
COARSE GRAVEL	0.75" TO 3.0"
FINE GRAVEL	5.0 mm TO 3.0"
COURSE SAND	2.0 mm TO 5.0 mm
MEDIUM SAND	0.4 mm TO 5.0 mm
FINE SAND	0.07 mm TO 0.4 mm
SILT	0.002 mm TO 0.07 mm
CLAY	LESS THAN 0.002 mm

DOCUMENT 00 4000
BID FORM

DATE: _____, 2024

PROJECT: Tarwater Veterinary Clinic
New Construction
802 E. Criner Street
Grandview, Texas

PROPOSAL OF: _____
hereinafter called "Bidder", a (corporation) (partnership) (sole proprietorship) (Bidder strike out inapplicable terms)

The undersigned, in compliance with your Advertisement for Bids, submits the following Bid.

1.01 REPRESENTATIONS

A. Bidder will accept the provisions of the Bidding Documents.

B. Bidder will enter into and execute a contract with the Owner within 10 days after notification of the acceptance of this Bid.

C. Bidder will accomplish the Work in accordance with the Bidding Documents prepared by Magee Architects, L.P.

1.02 TIME OF COMPLETION

A. Bidder will achieve Substantial Completion of the Work within the following calendar days after a Notice to Proceed is issued:

_____Days (_____)

1.03 BID AMOUNTS

A. Base Bid Amount: Bidder proposes to construct this project for the stipulated sum of:

_____Dollars (_____)

B. Add Alternate No. 1 Bidder proposes to construct the Add Alternate to provide Two (2) Stone Clad Corner Columns, an Aluminum Trellis and Four (4) Sconces at the building entry for the stipulated sum of:

_____Dollars (_____)

C. Unit Prices: The unit prices listed below, will apply throughout the project for changing work upon written instructions of the Architect:

Description	Unit of Measure	Add per Unit	Deduct per Unit
18" dia. piers	Linear foot	$_____	$_____
24" dia. piers	Linear foot	$_____	$_____

Description	Unit of Measure	Add per Unit	Deduct per Unit
Casing 18" dia. piers	Linear foot	$_____	$_____
Casing 24" dia. piers	Linear foot	$_____	$_____

1.04 ADDENDA

A. Bidder acknowledges receipt of the following Addenda:

No. 1 Dated _____, 2024.

No. 2 Dated _____, 2024.

No. 3 Dated _____, 2024.

No. 4 Dated _____, 2024.

Respectfully Submitted,

_____ _____
Firm Name By

_____ _____
Street Address Signature

_____ _____
City, State and Zip Code Title

_____
Telephone

Corporations: Affix Corporate Seal

_____
State in which incorporated

END OF DOCUMENT

DOCUMENT 00 6100

PERFORMANCE FORM

STATE OF TEXAS)(
)(KNOW ALL MEN BY THESE PRESENTS,
COUNTY OF)(

THAT, _____

_____

_____hereinafter called PRINCIPAL, and

_____

hereinafter called SURETY, are held and firmly bound unto_____

_____

hereinafter called OWNER, and unto all persons, firms, and corporations who may furnish materials for, or perform labor upon the building or improvements hereinafter referred to, in the penal sum of

_____DOLLARS ($_____)

in lawful money of the United States, are to be paid in _____

_____, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT WHEREAS, the Principal entered into a certain Contract with_____

_____

the Owner, dated the_____day of_____, A. D. 20_____
a copy of which is attached hereto and made a part hereof for

_____

_____

_____

_____

NOW THEREFORE, if the Principal shall well, truly and in good, sufficient and workmanlike manner, faithfully perform all the undertakings, covenants terms, conditions and agreements of said contract during the original terms thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damage, including claim for patent infringement, which it may suffer by reason of failure so to do, and shall fully reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER that if any legal action be filed upon said bond, venue shall lie in _____ County, Texas.

PROVIDED FURTHER that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work of the specifications.

PROVIDED FURTHER that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied, but the certificate of the Architect that any progress payment or final payment is due the Contractor or his assigns shall, when accepted and acted upon in good faith by the Owner, be conclusive upon the Surety and its successors and assigns.

IN WITNESS WHEREOF this is executed in two counterparts this the_____day of

_____ A. D. 20_____.

IN THE PRESENCE OF _____

(Principal)

_____ By_____

Witness

_____ _____

Address Address

_____ _____

Witness (Surety)

_____ _____

Address Address

By_____

Attorney-in-Fact

ATTEST: ATTEST:

_____ _____

SEAL (Contractor if Corporation) SEAL (Surety)

DOCUMENT 00 6200

STATUTORY PAYMENT BOND - TEXAS

KNOW ALL MEN BY THESE PRESENTS,

THAT, _____

_____

_____,

Original Contractor (hereinafter called the Principal), as Principal, and_____

_____,

a corporation organized and existing under the laws of the State of_____,

with its principal office in the City of _____(hereinafter

called the Surety), as Surety, are held and firmly bound unto _____

_____

(herein after called the Owner), in the amount of _____

_____DOLLARS ($_____)

(here insert amount equal to total contract price)

for the payment whereof the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the

Owner, dated the _____ day of _____, 20 ____, for _____

_____

_____

_____

_____

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT IF SAID PRINCIPAL shall promptly pay all claimants for all labor, subcontracts, materials and specially fabricated materials performed or furnished under or by virtue of said contract and duly authorized normal and usual extras thereto (not to exceed 15% of said contract price), then this obligation shall be void, otherwise to remain in full force and effect: labor, subcontracts, materials and specially fabricated materials shall be construed in accordance with Article 53.001 of Vernon's Texas Property Code.

PROVIDED, HOWEVER, that the Owner having required the said Principal to furnish this bond in order to comply with the provisions of the Article 53.201 through 53.211 of Vernon's Texas Property Code, all rights and remedies on this bond shall inure solely to such claimants and shall be determined in accordance with the provisions, conditions and limitations of said Article to the same extent as if they were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this_____day of_____, 20 _____.

IN THE PRESENCE OF:

(_____
(Principal (Seal)
(
(
(
(By_____
_____ Title:

(_____
(Surety (Seal)
(
(
(
(By_____
_____ Title: Attorney-In-Fact

The foregoing bond is hereby approved.

Owner _____

By _____

_____
Title

END OF DOCUMENT

DOCUMENT 00 7200

THE AMERICAN INSTITUTE OF ARCHITECTS

AIA DOCUMENT A201-2017
Sixteenth Edition

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

Articles 1 through 15, inclusive, of these referenced conditions are hereby made a part of the contract documents, the same as if printed in full and bound into each and every set. The general conditions and all modifications listed hereinafter shall apply to the general contract and all sub-contracts.

The document as attached, may be reviewed in the office of the Architect or may be purchased from the following places:

The American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006
202.626.7300

The American Institute of Architects
Fort Worth Chapter
Connex Office Park
1201 Evans Ave Ste 107
Fort Worth, TX 76104
817.334.0155

DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Tarwater Veterinary Clinic
802 E. Criner St
Grandview, Texas 76050

THE OWNER:
(Name, legal status and address)

Chris Tarwater DVM
802 E. Criner St
Grandview, Texas 76050

THE ARCHITECT:
(Name, legal status and address)

Magee Architects, L.P.
PO Box 101445
Fort Worth, Texas 76185

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the

Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's

responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in

Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any

direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with

reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible

for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the

Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented

to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;

.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The

Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds

of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the

other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

DOCUMENT 00 7300

SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 GENERAL

A. The following supplements modify, delete from, or add to the "General Conditions of the Contract for Construction", AIA Document A201-2007.

B. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

1.02 SUPPLEMENTS

A. Article 1 - General Provisions:

1. Add Subparagraph 1.1.9:

   1.1.8 The term "product" includes materials, systems, and equipment.

2. Add Subparagraph 1.1.10:

   1.1.9 The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, erection, placement or similar requirements.

3. Add Subparagraph 1.1.11:

   1.1.10 The term "install" means to unload, unpack, assemble, erect, place, finish, protect, adjust, and clean, or similar requirements.

4. Add Subparagraph 1.1.12:

   1.1.11 The term "provide" means to furnish and install.

5. Add Section 1.2.1.1 to Section 1.2.1:

   § 1.2.1.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

   .1 Modifications.

   .2 The Agreement.

   .3 Addenda, with those of later date having precedence over those of earlier date.

   .4 The Supplementary Conditions.

   .5 The General Conditions of the Contract for Construction.

   .6 Division 01 of the Specifications.

   .7 Drawings and Divisions 02 - 32 of the Specifications.

   .8 Other documents specifically enumerated in the Agreement as part of the Contract Documents.

   In the case of conflicts or discrepancies between Drawings and Divisions 02 - 32 of the Specifications, or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 4.2.11, 4.2.12, and 4.2.13.

B. Article 2 Owner

1. Delete Section 2.2.5 and substitute the following:

   § 2.2.5 The Owner shall furnish the Contractor all copies of the bidding documents returned in usable condition. The Contractor may purchase additional copies at the cost of reproduction, postage and handling.

C. Article 3 Contractor

1. Add Sections 3.4.1.1 and 3.4.1.3 to Section 3.4.1:

§ 3.4.1.1 Prevailing Wages. Attention is called to the Government Code, Chapter 2258, Prevailing Wage Rates. Among other things, this article provides that it shall be mandatory upon the Contractor and upon any Subcontractor under him to pay not less than the prevailing rate of per diem wages in the locality at the time of construction to all laborers, workmen and mechanics employed by them in the execution of this Contract.

§ 3.4.1.2 Not Used.

§ 3.4.1.3 The Contractor or any Subcontractor who violates the provisions of sections 3.4.1.1 hereof shall pay to Owner the sum of Sixty and No/100 Dollars ($60.00) for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rate stipulated in the scale of prevailing wages applicable to this project, as required by Texas Government Code Section 2258.023(b).

2. Add Section 3.4.2.1 to Section 3.4.2:

   § 3.4.2.1 After the Contract has been executed, the Owner and Architect will consider requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 01 of the Specifications). By making requests for substitutions, the Contractor:

   .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

   .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;

   .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and

   .4 shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

3. Add Section 3.6.2 and 3.6.3 to Section 3.6:

   § 3.6.2 The Owner qualifies for exemption from State and Local Sales Taxes pursuant to the provisions of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act.

   § 3.6.3 The Contractor performing this Contract may purchase materials and supplies used or consumed at the project site in the performance of this Contract by issuing to his suppliers an exemption certificate in lieu of the tax, said exemption certificate complying with Texas Tax Code Sections 151.309 or 151.310. Any such exemption certificate issued by the Contractor in lieu of the tax shall be subject to the provisions of the Texas Tax Code Sections 151.309 or 151.310.

4. Add Section 3.12.11 to Section 3.12:

   § 3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one re-submittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional re-submittals.

D. Article 4 - Architect:

1. Add Section 4.2.2.1 to Section 4.2.2:

   § 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work. Add Section 4.2.7.1:

2. Add Subparagraph 4.2.7.1:

   4.2.7.1 In no case will the Architect's review period on any submittal be less than 14 days for architectural submittals and 21 days for engineering submittals after receipt of the submittal from the Contractor.

E. Article 9 - Payments and Completion:

1. Add the following sentence to Section 9.3.1:

   The form of Application for Payment, duly notarized, shall be a current authorized edition of AIA Document G702™-1992, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703™-1992, Continuation Sheet.

2. Add the following Section 9.3.1.3 to Section 9.3.1:

   § 9.3.1.3 Until Substantial Completion, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments.

3. Add the following Section 9.8.3.1 to Section 9.8.3:

   § 9.8.3.1 The Architect will perform no more than two inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

4. Add the following Section 9.10.1.1 to Section 9.10.1:

   § 9.10.1.1 The Architect will perform no more than two inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

5. Add the following Section 9.11 to Article 9:

   § 9.11 The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the sums hereinafter stipulated as liquidated damages, and not as a penalty, for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete: $500.00 per day.

F. Article 10 - Protection of Persons and Property:

1. Add Paragraph 10.3.7:

   10.3.7 The Contractor shall not knowingly use any materials containing asbestos or other known hazardous materials in the Work.

G. Article 11 - Insurance and Bonds:

1. In Subparagraph 11.1.1, following the word "located", add "and against whom the Owner has no reasonable objection."

2. Add the following to the end of Subparagraph 11.1.3: "The form of the Certificate of Insurance shall be ACORD Form 25S".

3. Add Subparagraph 11.1.5:

   11.1.5 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

   .1 Premises-Operations including X, C and U coverages as applicable.

   .2 Independent Contractors' Protective.

   .3 Products and Completed Operations.

   .4 Personal Injury Liability with Employment Exclusion deleted.

.5 Contractual, including specified provision for Contractor's obligation under Paragraph 3.18.

.6 Owned, non-owned and hired motor vehicles.

.7 Broad Form Property Damage including Completed Operations."

4. Add Subparagraph 11.1.6:

11.1.6 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits or those required by law, whichever is greater and shall include the following coverages as a minimum:

.1 Worker's Compensation:

(a) State: Statutory.

(b) Applicable Federal: Statutory.

(c) Employer's Liability: $1,000,000 per accident; $500,000 per disease, Policy Limit; $100,000 per disease, each employee.

.2 Comprehensive or Commercial General Liability including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage:

(a) Bodily Injury: $500,000 each occurrence; $1,000,000 aggregate.

(b) Property Damage: $500,000 each occurrence; $1,000,000 aggregate.

(c) Products and Completed Operations shall be maintained for 1 year after final payment.

(d) Property Damage Liability: Include X, C and U coverage.

(e) Broad Form Property Damage shall include Completed Operations.

.3 Contractual Liability:

(a) Bodily Injury: $500,000 each occurrence; $1,000,000 aggregate.

(b) Property Damage: $500,000 each occurrence; $1,000,000 aggregate.

.4 Personal Injury, with Employment Exclusion deleted: $1,000,000 aggregate.

.5 Business Automobile Liability including owned, non-owned and hired vehicles:

(a) Bodily Injury: $500,000 each person; $1,000,000 each occurrence.

(b) Property Damage: $500,000 each occurrence.

.6 If General Liability coverages are provided by a Commercial Liability policy, the:

(a) General Aggregate shall be not less than $2,000,000 and it shall apply, in total, to this policy only.

(b) Fire Damage Limit shall be not less than $1,000,000 on any one Fire.

(c) Medical Expense Limit shall be not less than $500,000 on any one person.

.7 Umbrella Excess Liability:

(a) $1,000,000 over primary insurance.

(b) $1,000,000 retention for self-insured hazards each occurrence.

5. Modify the first sentence of Subparagraph 11.3.1 as follows: Delete "Unless otherwise provided, the Owner"; substitute "The Contractor."

6. Delete Subparagraph 11.4.1; substitute the following:

11.4.1 Furnish to Owner performance bond and labor and material payment bond, each equal to the amount of the Contract Sum, with approved surety, covering faithful performance of Contract and payment of obligations incurred in performance of Contract and also for use and benefit of parties who may become entitled to liens under the Contract according to provisions of laws of the State in which the project is located. The form of the bonds shall be acceptable to Owner.

.1 The Contractor shall deliver the required bonds to the Owner not later than three days following the date of execution of the Owner-Contractor Agreement, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

H. Article 12 Uncovering and Correction of Work

1. Add the following Section 12.2.2.4 to Section 12.2.2:

§ 12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

I. Article 15 - Claims and Disputes:

1. Add Paragraph 15.1.5.3:

15.1.5.3 Extensions of time because of inclement weather will be granted only for the following conditions at the site:

.1 Precipitation, defined as 0.1 inch or more of rain, snow, or ice, exceeds the mean for that month as published by the National Oceanic and Atmospheric Administration for the closest reporting station to the Project.

.2 Freezing weather, defined as a high daytime temperature of 32°F. or below, exceeds the mean for that month as published by the National Oceanic and Atmospheric Administration for the closest reporting station to the project.

.3 Sustained winds exceeding 25 MPH.

.4 Mud.

.5 Standing snow of 1 inch or more.

.6 Claims shall be in whole or half day increments. If both precipitation and freezing weather exceed the norm for any given day, only one day will be counted.

END OF DOCUMENT

SECTION 01 2200
UNIT PRICES

PART 1 - GENERAL

1.01 UNIT PRICES

A. Provide unit prices for items listed, for inclusion in contract, guaranteed to apply for duration of project as basis for additions to or deductions from Contract Sum.

B. Take measurements and compute quantities.

C. Quantities and measurements indicated are for contract purposes only. Actual quantities and measurements supplied or placed in the Work will determine payment.

D. Payment includes full compensation for all required labor, products, tools, equipment, plant, transportation, services, and incidentals, and for erection, application, or installation of an item of the Work.

E. Adjustments to Contract Sum will be made by change order based on net cumulative change for each item of the Work.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.01 UNIT PRICE SCHEDULE

A. Drilled Concrete Piers - Section 31 6329:

1. Pier Depth:
   a. Unit of Measure: By the linear foot including shaft drilling, dewatering, reinforcement, and concrete.
   b. Basis of Payment:
      1) Contract Sum to be based on design depths indicated on drawings.
      2) Adjustments to Contract Sum will be made using actual pier depth measured from top of pier to top of bearing strata. Payment for penetration into bearing strata is not included in unit price, and is to be included in Contract Sum.
2. Temporary Casings:
   a. Unit of Measure: By the linear foot including placement and removal.
   b. Basis of Payment:
      1) Cost of pier casings IS included in Contract Sum.
      2) If pier casings are not required Contract Sum will be adjusted based on actual depth measured from top of pier to top of bearing strata.

END OF SECTION

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 GENERAL

A. Definition: Proposal by Construction Manager to use manufacturer, product, material, or system different from one required in Contract Documents.

B. Do not substitute products unless a substitution request has been approved by Architect.

C. Architect will consider substitution requests within 60 days after award of Contract. After initial 60 day period, substitutions requests will be considered only due to non-availability of a specified Product through no fault of Construction Manager.

D. In case of non-availability of a specified product notify Architect in writing as soon as non-availability becomes apparent.

1.02 SUBSTITUTION REQUESTS

A. Submit substitution requests on copy of form bound into Project Manual.

B. Document specified product and proposed substitution with complete data, including:
   1. Product identification, including name and address of manufacturer.
   2. Product description, performance and test data, and reference standards.
   3. Sample, if requested.
   4. Description of any anticipated effect that acceptance of proposed substitution will have on Progress Schedule, construction methods, or other items of Work.
   5. Description of any differences between specified product and proposed substitution.
   6. Difference in cost between specified product and proposed substitution.

C. Burden of proof for substantiating compliance of proposed substitution with Contract Document requirements remains with Construction Manager.

D. A request constitutes a representation that the Construction Manager:
   1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
   2. Will provide the same warranty for the substitution as for the specified Product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner for design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the substitution.

E. Substitutions will not be considered if:
   1. They are indicated or implied on Shop Drawings or other submittals without submittal of a substitution request.
   2. Approval will require substantial revision of Contract Documents without additional compensation to Architect.

F. Submit electronically in Adobe PDF format.

G. Architect will notify Construction Manager of approval or rejection of each Substitution Request.

PART 2-- PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

(Substitution Request Form Below)

Substitution Request:

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____	_____
Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by:

Signature _____

Firm _____

Address _____

_____

Date _____

Telephone _____

For use by the Architect.

☐ Accepted ☐ Accepted as noted

☐ Not Accepted ☐ Received too late

By _____

Date _____

Remarks_____

Attachments:

SECTION 01 2600
CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Supplemental Instructions.
   2. Proposal Requests.
   3. Contractor proposed changes.
   4. Construction Change Directives.
   5. Change Orders.

B. Related Sections:
   1. Section 01 6000 - Product Requirements.

1.02 CHANGE PROCEDURES

A. Architect's Supplemental Instructions:
   1. Format: AIA Document G710 - Architect's Supplemental Instructions.
   2. Architect will advise of minor changes in Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract.

B. Proposal Requests:
   1. Format: AIA Document G709 - Proposal Request.
   2. Architect may issue a Proposal Request that includes a detailed description of a proposed change with supplemental or revised Drawings and specifications.
   3. Prepare and submit an estimate of any change to Contract Sum or Contract Time within [7] days after receipt. Include:
      a. Quantities and unit costs, with total cost or credit to Owner. Furnish documentation of quantities.
      b. Taxes, delivery charges, equipment rentals, and trade discounts as applicable.
      c. If change in Contract Time is involved, provide updated Progress Schedule.
   4. Do not stop work or initiate changes in response to a Proposal Request. If approved, Architect will prepare and issue a Change Order.
   5. Submit electronically in Adobe PDF format.

C. Contractor Proposed Changes:
   1. Format: Change Proposal Form as attached below.
   2. Contractor may propose a change by submitting request for change to Architect.
   3. Describe proposed change, reason for change, its full effect on Work, and any change to Contract Sum or Contract Time. Include:
      a. Quantities and unit costs, with total cost or credit to Owner. Furnish documentation of quantities.
      b. Taxes, delivery charges, equipment rentals, and trade discounts as applicable.
      c. If change in Contract Time is involved, provide updated Progress Schedule.
   4. Document any required substitutions in accordance with Section 01 2500 Substitution Procedures.
   5. Submit electronically in Adobe PDF format.

D. Construction Change Directive:
   1. Format: AIA Document G713 -Construction Change Directive.
   2. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change for subsequent inclusion in a Change Order.

3. Documentation will describe changes in Work and designate method of determining any change to Contract Sum or Contract Time. Promptly execute change.

E. Change Orders:

1. Format: AIA Document G701 - Change Order.
2. Execution: Architect will issue Change Orders for signature of parties as provided in Conditions of the Contract.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

(Change Proposal Form Below)

PROJECT_____ PROJECT NO._____

CONTRACTOR_____ CONTRACT NO._____

ARCHITECT_____ DATE_____

CHANGE PROPOSAL NO._____

Please complete all items.

1. DESCRIPTION OF PROPOSED CHANGE:

2. NECESSITY FOR PROPOSED CHANGE:

3. ORIGIN AND ORIGINATOR OF PROPOSED CHANGE:

4. CLASSIFICATION OF PROPOSED CHANGE (CIRCLE ONE)

(ERROR) (OMISSION) (UNFORESEEN) (REGULATORY) (OWNER REQ)
(UNAVAIL MAT'LS) (OTHER) _____

PROJECT_____ PROJECT NO._____

CHANGE PROPOSAL NO._____

5. ESTIMATED COST OF PROPOSED CHANGE

A. CONSTRUCTION COST (CONTRACTOR ESTIMATE) $_____

B. CONTRACTOR EXTRA SERVICE COMPENSATION $_____

6. PREPARATION AND RECOMMENDATION

BY: _____ DATE:_____
(GENERAL CONTRACTOR)

7. FUNDING

FUNDING IS AVAILABLE FOR THIS PROPOSED CHANGE

OWNER/ARCHITECT REPRESENTATIVE.....

8. RECOMMENDATION

	APPROVED	REJECTED
A. CONSTRUCTION MANAGER (UNDER $20,000)	☐	☐
B. DESIGN MANAGER (OVER $20,000, RECOMMEND APPROVAL/REJECTION)	☐	☐
C. GENERAL CONTRACTOR (OVER $20,000, RECOMMEND APPROVAL/REJECTION)	☐	☐
CONTRACTOR EXTRA COMPENSATION	☐	☐
D. ARCHITECT ($20,001 - $100,000)	☐	☐
E. OWNER ($100,001 AND OVER)	☐	☐
9. CHANGE PROPOSAL IS	☐	☐

10. REQUEST FOR GENERAL CONTRACTOR TO PREPARE A:

☐ COST REQUEST REPORT

☐ CONTRACT CHANGE ORDER

REMARKS:

_____
ARCHITECT/ENGINEER

SECTION 01 2613
REQUEST FOR INFORMATION PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. This section contains Request for Information (RFI) procedures to be used for this project.

1.02 REQUEST FOR INFORMATION PROCEDURES

A. The following procedures expand on the General Conditions and shall be followed by Contractor upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or upon having any question concerning interpretation.

B. Notification by Contractor

1. Submit all requests for clarification or additional information in writing to the Contract Project Manager with copies to the Architect, using the Request for Information form provided by the Construction Manager.
2. Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix as necessary for each resubmission. For example, the first RFI would be 001. The second RFI would be 002. The first resubmittal of RFI 002 would be 002a.
3. Limit each RFI to one subject.
4. Submit an RFI if one of the following conditions occurs:
   a. Contractor discovers an unforeseen condition or circumstance that is not described in the contract documents.
   b. Contractor discovers an apparent conflict or discrepancy between portions of the contract documents that appears to be inconsistent or is not reasonably inferred from the intent of the contract documents.
   c. Contractor discovers what appears to be an omission from the contract documents that cannot be reasonably inferred from the intent of the contract documents.
5. Contractor shall not
   a. Submit an RFI as a request for substitution.
   b. Submit an RFI as a submittal.
   c. Submit an RFI under the pretense of a contract documents discrepancy or omission without thorough review of the documents.
   d. Submit an RFI as an alternative to
      1) Reading manufacturer’s instructions
      2) Consulting references or industry standards cited by the contract documents
   e. Submit an RFI in a manner that suggests that specific portions of the contract documents are assumed to be excluded or by taking an isolated portion of the contract documents in part rather than whole.
   f. Submit an RFI in an untimely manner without proper coordination and scheduling of work of related trades.
   g. Use the quantity of RFIs as justification for additional compensation or extensions of time.

6. Contractor shall submit request for information or clarification immediately upon discovery. Contractor shall submit RFIs within a time frame so as not to delay the contract schedule while allowing the full response time described below.
7. RFI's shall clearly indicate the following information:
   a. Originating party
   b. Date by which the response is required
   c. Proposed solution if any
   d. Cost implication if any
   e. Response by Contractor or Contractor's Design Consultants, where appropriate
   f. Contractor's proposed solution
   g. Reference Contract Documents (e.g. Drawing, Specification Section, etc.) that clarify the question.
   h. keynoted on project record drawings and specifications with a brief description of the change (as a minimum) and a reference to the appropriate RFI.
8. Generate and submit requests to the Architect for information or interpretation of contract documents electronically on RFI form provided by the Construction Manager. Responses will be transmitted electronically. Establish and maintain an RFI Log and number each RFI sequentially.
9. Contractor shall provide Owner copy of RFI's in binders as part of the project drawings. See Section 01 7839 Project Record Documents.

C. Response Time
1. The Architect shall resolve such questions and issue instructions to Contractor within 10 days. In some cases this time may need to be lengthened for complex issues, or shortened for emergency situations, as mutually agreed in writing.
2. Should Contractor proceed with the work affected before receipt of a response from the Architect within the response time described above, any portion of the work which is not done in accordance with the architect's interpretations, clarifications, instructions, or decision is subject to removal or replacement and Contractor shall be responsible for all resultant losses.
3. Failure to Agree: In the event of failure to agree as to the scope of the contract requirement, Contractor shall follow procedures set forth in Article 31 Disputes of the General Conditions.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

Refer to Request for Information Procedures Form after this Section.

END OF SECTION

(EXAMPLE RFI FORM BELOW)

RFI Form Example for Use

Contractor Name _____	**Request for Information**
Contractor Phone ( ) ___-____ Address Fax ( ) ___-____	**RFI #_____**

Project Name	*Fill-in Project Name*		**RFI Date**	__/__/____

Brief Description of Question		Arch Job #	
		Owner's Rep Job	
		Contr Job	

To: _____, Project Manager

Magee Architects

2824 West 7th St, Suite 100

Fort Worth, TX 76107

Phone (817) 731-9392

www.magee-architects.com

Detailed Question / Request

_____

Anticipated Schedule Impact? Y / N # Days

Anticipated Cost Impact? Y / N $

Reference Documents: *List of Ref Design Documents - Drawing, Specs, Etc.*

Requested by: *Contractor Company Name* Date: ____/____/_____

Signed: *Contractor Representative*

Answer:

_____

Answered by: _____ Date: ____/____/_____

Signed: _____

SECTION 01 30 00
PROJECT DOCUMENTATION

PART 1 – GENERAL

1.01 PHOTOGRAPHY

A. Provide photographs taken each month just prior to date for each scheduled Application for Payment.

B. Provide one aerial photograph of site at beginning and completion of work at site.

C. Photograph project from four different views at each specified time; views as directed by Architect.

D. After interior finish work is commenced, take minimum of 12 additional photographs of interior; views as directed by Architect.

E. At successive periods of photography, take photographs from same overall view as previously taken.

F. Utilize digital technology at minimum 1216 x 912 capture resolution.

G. Provide factual presentation.

H. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1.02 DIGITAL FILES

A. Index digital files in chronological sequence.

B. Identify each view by listing:

1. Name of Project.
2. Orientation of view.
3. Date taken.
4. Sequential photograph number.

1.03 SUBMITTAL

A. Submit each month’s digital files along with each Application for Payment.

B. Submit full set of digital files along with Project Record Documents.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01 3100
CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.01 SUMMARY

A. Work included: To assure adequate planning and execution of the work so that the work is completed within the number of calendar days allowed in the Contract & to assist the Owner's Representative in appraising the reasonableness of the proposed schedule in evaluating progress of the work and assessing liquidated damages for breach of contract. Prepare and maintain the schedules and reports described in this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
2. Construction period: Form of Agreement.

1.02 PROJECT MEETINGS

A. Pre-Construction Conferences:

1. Prior to commencing construction, the Contractor shall schedule with the Owner, Architect & Sub-Contractors a meeting to review all aspects of the Construction Project. The time of the Pre-Construction Conference and the attendees shall be determined through discussions between the Owner and Architect prior to scheduling.
2. The following is a tentative agenda for the Pre-Construction Conference:
   a. Critical work sequencing;
   b. Designation of responsible personnel;
   c. Procedures for processing submittals, substitutions, applications for payment, proposal requests, change letters and Contract Closeout procedures;
   d. Parking and access to the site;
   e. Office, storage areas and temporary facilities;
   f. Utility information;
   g. Testing procedures;
   h. Procedures for maintaining record documents.
3. Minutes of the Pre-Construction Conference will be kept and distributed to all attendees and to all team members not present at the meeting. All final decisions recorded in the minutes shall become binding on the parties.

B. Pre-Installation Conferences:

1. Conduct a Pre-installation Conference at the site before each construction activity that requires extensive coordination and for those activities where a pre-installation meeting is specifically required by the specification section.

C. Progress Meetings:

1. The Contractor shall schedule progress meetings at regular intervals to discuss and monitor the construction project. The Contractor shall determine the meeting times and required attendees.
2. Minutes of the Progress Meeting shall be kept and distributed to all attendees and to all team members not present at the meeting.

D. Close-out Meetings:
   1. When the Contractor determines that a Project, including all punch list items, has been substantially completed and an acceptance date established, a formal project close-out meeting will be scheduled and attended by the parties designated by the Owner and A/E.
   2. At the close-out meeting, upon documentation of exceptions and assignment of completion responsibilities, the close-out documents required by the Construction Documents will be released to the Owner.
   3. Minutes of the Project Close-out meeting will be kept by the A/E and any exceptions identified will be recorded. Specific completion dates for the exceptions will be established and tracked by the Owner to ensure expeditious completion. Copies of the minutes will be distributed to all attendees.

1.03 QUALITY ASSURANCE

A. Time for completion: The work shall be commenced within ten (10) days from the date of the Notice to Proceed from the Owner & Architect. The Contractor agrees that the work shall be prosecuted regularly, diligently and uninterruptedly at a uniform rate of progress so as to ensure completion within the contracted calendar days as stated in the Bid Proposal. It is expressly understood and agreed that the said time for completion of the work described herein is a reasonable time for the completion of same. If the Contractor fails to substantially complete the work of the contract as indicated within the time specified, then the Contractor agrees to pay to the Owner, not as a penalty, but as liquidated damages for such breach of contract, the sum as noted in the General Conditions for each and every calendar day of failure to complete the work after the specified time set forth in the Bid Proposal. The said amount is fixed and agreed upon because of the impracticality and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. A Certificate of Substantial Completion must be executed by the Owner's Representative and Contractor stating the contract status. At Substantial Completion, a project must be available for Owner's intended purpose.

B. Perform data preparation, analysis, charting and updating in accordance with standards approved by the Owner's Representative.

1.04 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300 Submittal Procedures.

B. Preliminary analysis: Within ten calendar days after the Contractor has received the Owner's Notice to Proceed, submit one reproducible copy and four prints of a preliminary construction schedule prepared in accordance with Part 3 of this Section.

C. Construction schedule: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit one reproducible copy and four prints of a construction schedule prepared in accordance with Part 3 of this Section.

D. Periodic reports: On the first working day of each month following the submittal described in Paragraph 1.03 C. above, submit four prints of the construction schedule updated as described in Part 3 of this Section.

PART 2- PRODUCTS

2.01 CONSTRUCTION ANALYSIS

A. Graphically show by bar-chart the order and interdependence of all activities necessary to complete the work and the sequence in which each activity is to be accomplished, as planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram.

B. Include, but do not necessarily limit indicated activities to:

1. Project mobilization.
2. Submittal and approval of Shop Drawings and Samples.
3. Procurement of equipment and critical materials.
4. Fabrication of special material and equipment, and its installation and testing.
5. Final cleanup.
6. Final inspecting and testing.
7. All activities by the Owner's Representative that effect progress, required dates for completion, or both, for all and each part of the work.

PART 3 - EXECUTION

3.01 PRELIMINARY ANALYSIS

A. Contents:

1. Show all activities of the Contractor under this work for the period between receipt of Notice to Proceed and submittal of construction schedule required under Paragraph 1.03 C. above.
2. Show the Contractor's general approach to remainder of the work.
3. Show cost of all activities scheduled for performance before submittal and approval of the construction schedule.

B. Submit in accordance with Paragraph 1.03 B. above.

3.02 CONSTRUCTION SCHEDULE

A. As soon as practicable after receipt of Notice to Proceed, complete the construction analysis in preliminary form, meet with the Owner's Representative, review contents of the proposed construction schedule and make all revisions agreed upon.

B. Submit in accordance with Paragraph 1.03 C. above.

3.03 PERIODIC REPORTS

A. As required under Paragraph 1.03 D. above, update the approved construction schedule.

1. Indicate "actual" progress in percent completion for each activity.
2. Provide written narrative summary of revisions causing delay in the program and an explanation of corrective actions taken or proposed.

3.04 REVISIONS

A. Make only those revisions to approved construction schedule as are approved in advance by the Owner.

END OF SECTION

SECTION 01 3233
PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.01 PHOTOGRAPHY

A. Provide photographs taken each month just prior to date for each scheduled Application for Payment.
B. Provide one aerial photograph of site at beginning and completion of work at site.
C. Photograph project from four different views at each specified time; views as directed by Architect.
D. After interior finish work is commenced, take minimum of 12 additional photographs of interior; views as directed by Architect.
E. At successive periods of photography, take photographs from same overall view as previously taken.
F. Utilize digital technology at minimum 1216 x 912 capture resolution.
G. Provide factual presentation.
H. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1.02 DIGITAL FILES

A. Index digital files in chronological sequence.
B. Identify each view by listing:
    1. Name of Project.
    2. Orientation of view.
    3. Date taken.
    4. Sequential photograph number.

1.03 SUBMITTAL

A. Submit each month’s digital files along with each Application for Payment.
B. Submit full set of digital files along with Project Record Documents.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUBMITTAL PROCEDURES

A. Number each submittal with project manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.

B. Identify project, Construction Manager, Subcontractor or supplier, pertinent drawing sheet and detail numbers, and specification section number, as appropriate.

C. Submit all submittals listed under “Submittals for Review” simultaneously for each product or specification section.

D. Where multiple products function as an assembly, group submittals for all related products into single submittal.

E. Architect will not review incomplete submittals.

F. Apply Construction Manager's stamp, signed or initialed certifying that:

1. Submittal was reviewed.
2. Products, field dimensions, and adjacent construction have been verified.
3. Information has been coordinated with requirements of Work and contract documents.

G. Schedule submittals to expedite the Project, and deliver to Architect. Coordinate submittal of related items.

H. Colors: Submit interior and exterior material color samples in a timely manner to ensure coordination of material color scheme. Materials, which are dependent upon color selections, may not be released until all materials requiring color selections are received and reviewed.

I. For each submittal, allow 14 days for Architect’s review, excluding delivery time to and from Construction Manager.

J. Identify variations from contract documents and product or system limitations that may be detrimental to successful performance of completed Work.

K. Revise and resubmit submittals when required; identify all changes made since previous submittal.

L. Distribute copies of reviewed submittals to concerned parties and to project record documents file. Instruct parties to promptly report any inability to comply with provisions.

1.02 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

C. Submit electronically as *.pdf (Portable Document Format) files.

1.03 SUBMITTAL SCHEDULE

A. Within 15 days after date of Notice to Proceed, submit a submittal schedule showing all submittals proposed for project, including submittals listed as:

1. Submittals for Review.

1.07 QUALITY CONTROL SUBMITTALS

A. Quality control submittals specified are for information and do not require Architect's responsive action except to require resubmission of incomplete or incorrect information.

PART 2 - PRODUCTS - Not used.

PART 3 - EXECUTION

SUBMITTAL SCHEDULE

Section No.	Section Title	Submittal Requirements
DIVISION 01 - GENERAL REQUIREMENTS		
01 3300	Submittal Procedures	Proposed Products List Submittal Schedule
01 7700	Closeout Procedures	Final Inspection; Written Certification Final Application for Payment Closeout Submittals 1. Evidence of compliance with requirements of governing authorities. 2. Certificate of Occupancy. 3. Project Record Documents. 4. Operation and Maintenance Data. 5. Warranties. 6. Keys and keying schedule. 7. Spare parts and maintenance materials. 8. Evidence of payment of Subcontractors and suppliers. 9. Final lien waiver. 10. Certificate of insurance for products and completed operations. 11. Consent of Surety to final payment. 12. Project Record Documents 13. Operation and Maintenance Data 14. Warranties 15. Spare Parts and Maintenance Materials
DIVISION 03 - CONCRETE		
03 1000	Concrete Forming	Shop Drawings
03 2000	Concrete Reinforcing	Shop Drawings
03 3000	Cast-in-place Concrete	Concrete Mix Design
DIVISION 04 - MASONRY		
04 2113	Brick Veneer Masonry	Product Data Samples
DIVISION 05 - METALS		
05 1200	Structural Steel Framing	Shop Drawings
05 4000	Cold-formed Metal Framing	Product Data
05 5000	Metal Fabrications	Shop Drawings
05 5213	Pipe and Tube Railings	Shop Drawings
DIVISION 06 - WOOD, PLASTICS AND COMPOSITES		
06 1000	Rough Carpentry	Product Data
06 4100	Architectural Wood Casework	Shop Drawings Product Data Samples
DIVISION 07 - THERMAL AND MOISTURE PROTECTION		
07 1900	Water Repellents	Product Data Warranty
07 2113	Board Insulation	Product Data

07 2115	Batt Insulation	Product Data
07 2726	Fluid-Applied Air & Water Resistant Barrier System	Product Data
07 9200	Joint Sealers	Product Data
DIVISION 08 - OPENINGS		
08 1113	Hollow Metal Doors and Frames	Shop Drawings Product Data Certificates of Compliance
08 3100	Access Doors & Panels	Product Data
08 5619	Pass-Thru Windows	Shop Drawings Product Data
08 7100	Door Hardware	Shop Drawings Product Data Warranty Closeout Submittal 1. Copy of approved hardware schedule. 2. Keying list. 3. Keys
08 8000	Glazing	Product Data Samples Warranty
08 8300	Mirrors	Product Data Samples
08 9100	Louvers and Vents	Shop Drawings
DIVISION 09 - FINISHES		
09 2400	Portland Cement Plastering	Product Data Samples Warranty
09 2900	Gypsum Board Assemblies	Product Data
09 3000	Tiling	Product Data Samples
09 5100	Suspended Acoustical Ceilings	Product Data Samples
09 6519	Resilient Tile Flooring	Product Data Samples
09 9100	Painting	Product Data Samples
DIVISION 10 - SPECIALTIES		
10 1400	Identifying Devices	Product Data Samples
10 2117	Plastic Toilet Partitions	Product Data Samples
10 2613	Corner Guards	Product Data
10 2813	Toilet Accessories	Product Data Warranty
10 4413	Fire Extinguishers and Cabinets	Product Data Closeout Submittals; Maintenance Data
10 9900	Miscellaneous Specialties	Product Data
DIVISION 11 - EQUIPMENT		
11 3100	Appliances	Product Data Warranty Operation and Maintenance Data
DIVISION 12 - FURNISHINGS		
12 2113	Horizontal Louver Blinds	Product Data Samples

DIVISION 22 - PLUMBING		
22 0000	Plumbing – General Provisions	Product Data Warranty Operation and Maintenance Data
DIVISION 23 - MECHANICAL		
23 0000	Mechanical - General Provisions	Layout drawings and lists of materials, fixtures, and equipment to be incorporated in the work. Lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. Record Drawings Spare Parts Data Catalog Data for Owner
23 3101	Ductwork and Devices	Shop Drawings
DIVISION 26 - ELECTRICAL		
26 0000	Electrical - General Provisions	List of materials, fixtures, and equipment to be incorporated in the work. Lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards. Data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. Submittals shall include the following: Conduit and fittings Devices and plates Fire alarm system additions Lighting fixtures Standby generator system Switchgear Wire and cable Record Drawings Catalog data for Owner
DIVISION 31 - EARTHWORK		
31 2300	Excavation and Fill	Test Reports
31 3116	Termite Control	Product Data
DIVISION 32 – EXTERIOR IMPROVEMENTS		
32 3119	Decorative Metal Fences & Gates	Shop Drawings Product Data

END OF SECTION

MAGEE ARCHITECTS, L.P.

SECTION 01 3350
SUBMITTAL SCHEDULE

Tarwater Veterinary Clinic – New Building
802 E. CRINER ST.
GRANDVIEW, TX 76050

SUBMITTAL SCHEDULE

Section No.	Section Title	Submittal Requirements
DIVISION 01 - GENERAL REQUIREMENTS		
01 3300	Submittal Procedures	Proposed Products List Submittal Schedule
01 6400	Owner Furnished Contractor Installed Products	Proposed Benco Dental Products List Accessory Equipment Identified by Owner
01 7700	Closeout Procedures	Final Inspection; Written Certification Final Application for Payment Closeout Submittals 1. Evidence of compliance with requirements of governing authorities. 2. Certificate of Occupancy. 3. Project Record Documents. 4. Operation and Maintenance Data. 5. Warranties. 6. Keys and keying schedule. 7. Spare parts and maintenance materials. 8. Evidence of payment of Subcontractors and suppliers. 9. Final lien waiver. 10. Certificate of insurance for products and completed operations. 11. Consent of Surety to final payment. 12. Project Record Documents 13. Operation and Maintenance Data 14. Warranties 15. Spare Parts and Maintenance Materials
DIVISION 03 - CONCRETE		
03 1000	Concrete Forming	Shop Drawings
03 2000	Concrete Reinforcing	Shop Drawings
03 3000	Cast-in-place Concrete	Concrete Mix Design
03 3518	Integrally Colored Concrete	Shop Drawings Product Data **Herringbone** – Dark Granite SG860-5
DIVISION 04 - MASONRY		
04 4000	Stone Veneer Masonry	Product Data Samples **Type: Coronado Stone-Pro Ledge-Black Forest** **Mortar Color Additive**: Mineral oxide pigment **Black/Grey Color**
04 7200	Cast Stone Masonry	Product Data Samples **Color**: Natural Limestone Texture, **Dove Grey** **Finish**: Acid etched, **Medium Finish**

Section No.	Section Title	Submittal Requirements
DIVISION 05 - METALS		
05 1200	Structural Steel Framing	Shop Drawings
05 4000	Cold-formed Metal Framing	Product Data
05 5000	Metal Fabrications	Shop Drawings
DIVISION 06 - WOOD, PLASTICS AND COMPOSITES		
06 1000	Rough Carpentry	Product Data
06 1600	Gypsum Sheathing	Shop Drawings Product Data
06 1753	Shop Fabricated Wood Trusses	Shop Drawings Product Data
06 4100	Architectural Wood Casework	Shop Drawings Product Data Samples **Plastic Laminate Casework & Countertops**: **Plastic Laminate**: • WilsonArt Traceless Charcoal Velvet 15504 **Mfg. Stone or Solid Surface**: • Cambria USA – Annica • WilsonArt - Angel Falls 9223SS
DIVISION 07 - THERMAL AND MOISTURE PROTECTION		
07 1110	Dampproofing	Product Data Manufacturer's Instructions
07 1313	Bituminous Sheet Waterproofing	Shop Drawings Product Data Sample Warranty
07 1326	Self-Adhering Sheet Waterproofing	Shop Drawings Product Data Sample Warranty
07 1900	Water Repellents	Product Data Sample Warranty
07 2100	Building Insulation	Product Data Manufacturer's Instructions
07 2600	Vapor Barriers & Retarders – Below Slab	Product Data Manufacturer's Instructions
07 2800	Weather Barrier	Product Data
07 4113	Metal Roof Panels	Shop Drawings Product Data Samples & Sample Warranty **Manufacturer**: Berridge **Color**: **Charcoal Grey or Matte Black**
07 4646	Fiber-Cement Panels	Shop Drawings Product Data Samples Sample Warranty
07 8400	Penetration Firestopping	Certifications Test Reports Penetrations Schedule
07 9200	Joint Sealers	Product Data
07 9500	Expansion Control	Shop Drawings Samples & Product Schedule
Section No.	**Section Title**	**Submittal Requirements**

DIVISION 08 - OPENINGS		
08 1113	Hollow Metal Doors and Frames	Shop Drawings Product Data & Certificates of Compliance **Type**: Ceco Door Products **Grade**: II - Heavy Duty **Model**: 2 - Seamless **Finish**: Dark Bronze
08 1216	Interior Aluminum Doors, Door Frames & Storefront Framing	Shop Drawings Product Data & Samples **Basis-of-Design**: **RACO** Classic Prestige **Finish**: Class II **Bronze Anodized**.
08 1423	Plastic-Laminate-Faced Wood Doors	Shop Drawings Product Data & Samples **Mfg**.: Wilsonart - Premium Laminate **Type**: Branded Oak #8207k-16, Casual Rustic Finish
08 1433	Stile & Rail Wood Panel Barn Doors	Shop Drawings Samples & Sample Warranty **Mfg**.: Basis-of-design: **TruStile Doors**, Finish selected from mfg's product samples. Coordinate Finish Selection with Hardware Selection
08 3100	Access Doors & Panels	Product Data
08 4113	Aluminum-Framed Entrances and Storefronts	**Basis-of-Design**: • Entrances and Storefronts; YKK YES 45 TU by YKK AP America, Inc. • Entrance Doors; YKK 35XT, YKK AP America, Inc. **Color**: **Statuary Bronze**, AA-M10C12C22A44 **Dark Bronze** anodized coating
08 4413	Glazed Aluminum Curtain Walls	Shop Drawings Product Data Samples
08 5240	Aluminum Fixed Windows	Shop Drawings Product Data & Samples **Basis-of-Design**: • Fixed Windows; YKK YES 45 TU by YKK AP America, Inc. **Color**: **Statuary Bronze**, AA-M10C12C22A44 **Dark Bronze** anodized coating
08 7100	Door Hardware	Shop Drawings Product Data Warranty Closeout Submittal 1. Copy of approved hardware schedule. 2. Keying list. 3. Keys **Finishes**: US10BE-**Dark Oxidized Satin Bronze**. **Door Closers**: Finish No. 690, **Dark Statuary Bronze** enamel. **Hinges at Fire-rated Doors**: Finish No. 640, **Satin Bronze** plated, oxidized and oil rubbed. **Thresholds and Door Seal Housings**: **Bronze** anodized. **Other**: Finish No. 613, **Satin Bronze**, oxidized and oil rubbed.
Section No.	**Section Title**	**Submittal Requirements**
08 8000	Glazing	Product Data

		Samples & Warranty **Color: Viracon Opti-Grey over Clear**
08 9100	Louvers and Vents	Shop Drawings **Color**: Construction Specialties - Pre-finished **#549 Charcoal**
DIVISION 09 - FINISHES		
09 2900	Gypsum Board Assemblies	Product Data
09 3000	Tiling	Product Data & Samples **Product**: • Interceramic Union Square in York – Glazed PEI IV / STS Moderate - 8" x 8" • Daltile Beveled Subway Tile – RetroSpace Glazed Ceramic-Modern White RS30- 3" x 6" Glossy • Daltile Emerson Wood Colorbody Porcelain-Ash White EP06 3D cube Matte – 12 x 12
09 5100	Suspended Acoustical Ceilings	Product Data & Samples **Panels & Grid System**: Rockfon – **Tropic-White** Exposed T grid type-**White**
09 6519	Resilient Tile Flooring	Product Data & Samples **Vinyl Composition Tile (VCT)**: • Armstrong-Standard Excelon - Imperial Texture, #51830 Cottage Tan - 12" X 12"
09 6520	Resilient Flooring – Luxury Vinyl Tile	Product Data & Samples **Luxury Vinyl Tile (LVT)**: • Shaw Contract Terrain II LVT- Style: 4110V Color: Root #00568 - 20 Mil x 5 Mm – 6 in. x 48 in.
09 6536	Static-Control Resilient Flooring	Product Data & Samples **Static Control Resilient Flooring (VCT):** • Armstrong ESD-Static Control Flooring #51954 Sandstone Beige
09 6813	Tile Carpeting (Architect Option)	Product Data & Samples **Product**: Shaw - **Intention Tile** 5T360 **Color**: **Lacquer** 58496 - 24" X 24".
09 7733	Sanitary Wall Panels	Product Data & Samples **Product**: Marlite - Glass Fiber-Reinforced Plastic **Color**: **Almond** #S118G
09 9100	Painting	Product Data & Samples **Color**: Owner to select from mfg.'s product samples & approved from contractors drawdowns. • Sherwin Williams - SW 7615 Sea Serpent • Sherwin Williams – SW 7636 Origami White
Section No.	**Section Title**	**Submittal Requirements**
DIVISION 10 - SPECIALTIES		

10 1123	Bulletin Boards	Product Data & Samples **Aluminum Extrusions**: Provide manufacturer's standard colors for Owner Selection **Glass**: Provide clear, tempered safety glass
10 1400	Identifying Devices	Product Data & Samples **Signs**: Provide minimum of one sign for each Restroom. 1. **Type**: Melamine plastic laminate with contrasting color core, non-static, fire-retardant, self-extinguishing, matte finish. 2. **Thickness**: 1/8 inch. 3. **Face and core colors**: To be selected from manufacturer's full color range.
10 2600	Wall & Door Protection	Shop Drawings Product Data Samples
10 2813	Toilet Accessories	Product Data & Warranty **Stainless Steel**: No. 4 satin. **Galvanizing**: ASTM A 123 to 1.25 ounces per square foot. **Chrome Plating**: ASTM B 456, Type SC 2, polished.
10 4413	Fire Extinguishers and Cabinets	Product Data Closeout Submittals; Maintenance Data **Cabinet**: Exterior and Door: Baked enamel, **White**. Interior: Baked enamel, **White**. **Brackets**: Baked enamel, **White color**. **Extinguishers**: Baked enamel, **Red color**.
10 5113	Metal Lockers	Shop Drawings Product Data **Product**: Lyon Lockers **Type**: Steel: Baked enamel **Color**: **DD Dove Gray**
10 7310	Carport Canopies	Shop Drawings & Metal Panel Samples **Prefabricated Canopy System**: Avadeck - Match materials and finishes of Metal Roofing
10 7500	Ground-Set Flagpoles	Shop Drawings & Product Data **Aluminum Flagpole**: Located near front entrance walk. Exposed height 30 feet, 6-inch ball diameter.
10 9900	Miscellaneous Specialties	Product Data
DIVISION 11 - EQUIPMENT		
11 3100	Appliances	Product Data & Maintenance Data **Refrigerator**: GE - Stainless Steel **Undercounter Beverage Refrigerator**: Summit – **Stainless Steel** with Glass Door **Microwave Oven**: Panasonic – **Stainless Steel** **Dishwasher**: GE – **Stainless Steel** **Stackable Washer & Dryer**: GE – **Stainless Steel** **Disposer**: Insinkerator - **Grey Enamel** **Flat Screen Wall Mount**: Lucasey - **Black** **Flat Screen Ceiling Mount**: Lucasey - **Black** **Camera Ceiling Mount**: Lucasey - **Black** **Undercounter Icemaker**: GE - **Stainless Steel**
Section No.	**Section Title**	**Submittal Requirements**

11 3200	Retractable Stairs	Shop Drawings Product Data
11 4000	Dental Fixtures and Equipment	**Fixtures**: **Stainless steel** shall be 18-8, Type 304, stainless steel polished to 180 grit No. 4 finish **Equipment**: Benco Product (N.I.C.)
DIVISION 12 - FURNISHINGS		
12 2413	Roller Window Shades	Shop Drawings/Product Data/Shade Samples Roller-Shade Schedule **Product**: Hunter Douglas-**Fabric – T.B.D.**
124813	Entrance Floor Mats	Shop Drawings/Product Data/Tread Samples **Product**: Balco. **Frame**: Square edge vinyl. **Tread Inserts**: Exterior carpet **Color**: **Black Rain**
12 9300	Site Furnishings	Product Data
DIVISION 22 - PLUMBING		
22 0000	Plumbing – General Provisions	Product Data Warranty Operation and Maintenance Data **Plumbing Fixtures**: **Porcelain White**
DIVISION 23 - MECHANICAL		
23 0000	Mechanical - General Provisions	Layout drawings and lists of materials, fixtures, and equipment to be incorporated in the work. Lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. Record Drawings Spare Parts Data Catalog Data for Owner
23 3101	Ductwork and Devices	Shop Drawings **Diffuser Grills**: **Grey**
Section No.	**Section Title**	**Submittal Requirements**
DIVISION 26 - ELECTRICAL		

26 0000	Electrical - General Provisions	List of materials, fixtures, and equipment to be incorporated in the work. Lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards. Data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. Submittals shall include the following: Conduit and fittings Devices and plates **Electrical Outlets**: **Grey** **Cover Plates**: **Stainless Steel** Fire alarm system additions Lighting fixtures Standby generator system Switchgear Wire and cable Record Drawings Catalog data for Owner
DIVISION 31 - EARTHWORK		
31 3116	Termite Control	Product Data
DIVISION 32 – EXTERIOR IMPROVEMENTS		
32 1726	Tactile Warning Surfacing	Samples
32 1900	Walk, Road & Parking Appurtenances	Product Data
32 3115	Wood Fences & Gates	Shop Drawings Manufacturer's Data Sheets Compliance Certificates
32 9113	Soil Preparation	Product Data
32 9120	Topsoil Placement & Grading	Product Data

END OF SECTION

SECTION 01 3546
INDOOR AIR QUALITY MANAGEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Indoor Air Quality Management Plan.
   2. During construction:
      a. Protection of heating, ventilating, and air conditioning systems.
      b. Reducing emissions through source control.
      c. Pathway interruption.
      d. Housekeeping.
      e. Scheduling.
   3. Before occupancy: Provide System Flush-out and Air testing.

1.02 SUBMITTALS

A. Indoor Air Quality Management Plan:
   1. Submit Indoor Air Quality Management Plan for review within 14 days after date of Notice to Proceed. Include:
      a. Procedures for implementing requirements of SMACNA IAQ Guideline.
      b. Substitution procedures for products that are responsibility of Construction Manager and proposed source control implementation measures to minimize building contamination.
      c. Construction sequencing and storage plans for protection of stored on-site or installed absorptive materials against moisture absorption and contamination.
      d. Filter media change schedule and Product Data for filters including MERV ratings.
      e. Name and phone number of Construction Manager's personnel responsible for instructing workers and overseeing and documenting results of Indoor Air Quality Management Plan.
   2. Submit electronically in Adobe PDF format.
   3. If required, revise and resubmit plan within ten days after receipt of comments.
   4. Distribute copies of approved Indoor Air Quality Management Plan to concerned parties.

B. Photographs: Document indoor air quality management measures with date-stamped photographs including protection of ducts, on-site storage, and protection of installed absorptive materials.

C. Indoor Air Quality Testing Report showing results of air quality testing.

1.03 QUALITY ASSURANCE

A. Review and discuss Indoor Air Quality Management Plan implementation and progress at Preconstruction Conference and Progress Meetings.

1.04 DELIVERY, STORAGE AND HANDLING

A. Designate specific storage areas to facilitate protection of stored absorptive materials.

B. Clearly identify storage area. Keep clean and orderly; prevent contamination of materials.

C. Monitor storage areas for contamination; correct problems and implement preventative measures.

1.05 TRAINING

A. Provide training of indoor air quality management methods to be used at appropriate stages of Project.

B. Require participation of all subcontractors.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 IMPLEMENTATION - DURING CONSTRUCTION

A. Meet or exceed SMACNA minimum requirements for heating, ventilating, and air conditioning system protection, source control, pathway interruption, housekeeping, and scheduling.

B. Protect stored on-site or installed absorptive materials from moisture damage and volatile organic compound contamination through construction sequencing and proper storage. Provide date stamped photographs throughout construction showing how absorptive materials are collected.

C. If air handlers are used during construction, use filtration media with Minimum Efficiency Reporting Value (MERV) of 8 per ASHRAE 52.2.

D. Replace filtration media just prior to occupancy.

E. Heating, Ventilating, and Air Conditioning System Protection:

1. Keep duct systems including supply air, return air, and exhaust air and associated equipment Including air handlers, variable air volume boxes, silencers, fans, and filter boxes, clean and uncontaminated.
2. Seal taps and open ends not actively being worked on with plastic and tape.
3. Provide 1 inch polyester filter media over return and exhaust air inlets during construction and until Substantial Completion.
4. Ensure that temporary and permanent filters are in place and openings are closed before running fans.
5. Protect existing heating, ventilating, and air conditioning systems with 1 inch polyester media Installed over outside air intakes. Change out filter media on intakes to minimize pressure drops. Provide frequent filter change out to keep filter pressure drop at existing fan-coils below approximately 0.30 inch s.p.

F. Source Control:

1. For temporary and ancillary materials used in construction, follow requirements of similar products to minimize indoor air quality impacts.
2. Use nontoxic formulations and implement other control measures to minimize building contamination.

G. Pathway Interruption: Isolate areas where work is being performed to prevent contamination of clean and occupied spaces.

H. Housekeeping:

1. Implement cleaning activities concentrating on heating, ventilating, and air conditioning systems and building space to remove contaminants prior to occupancy.
2. Protect materials from weather and store in clean area prior to unpacking.
3. Clean coils, air filters, and fans before performing testing and balancing.
4. Provide temporary walk-off mats at entry points to construction areas; replace or clean daily.

I. Scheduling:

1. Sequence construction activities to reduce absorption of and volatile organic compounds by materials.
2. Complete applications of wet and odorous materials before installing absorptive materials.

3.02 IMPLEMENTATION - BEFORE OCCUPANCY

A. After completion of construction, prior to Owner occupancy, and after completion of interior finishes, perform building flush-out:
   1. Supply total air volume of 14,000 CF of outdoor air per square foot of floor area.
   2. Maintain minimum interior temperature of 60 degrees F and maximum relative humidity of 60 percent during flush-out.
   3. Timeframe estimated to be 2 Days/48 Hours.

B. Replace filtration media after final cleaning with MERV 13 filers.

C. Complete air testing and balancing prior to beginning baseline air testing.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 REGULATORY REQUIREMENTS

A. Asbestos:

1. Contract Documents for this Project have been prepared in accordance with generally accepted professional architectural and engineering practices. Accordingly, no asbestos or products containing asbestos have been knowingly specified for this Project. Notify Architect immediately for instructions if:
   a. Materials containing asbestos are brought to site for inclusion in the Work.
   b. Asbestos containing materials are encountered in existing structures upon which work is being done.
2. At Architect's direction and with Owner's approval, a certified asbestos inspector will collect samples and an independent testing laboratory will perform testing procedures on suspect materials.
3. Certify that based upon best knowledge, information, inspection, and belief no building materials containing asbestos were used in construction of Project. Submit certification on form provided by Owner.

1.02 REFERENCES

A. Reference Standards:

1. Industry Standards:
   a. Except where Contract Documents specify otherwise, construction industry standards will apply and are made a part of Contract Documents by reference.
   b. Where compliance with two or more standards is specified and standards apparently establish different or conflicting requirements for minimum quantities or quality levels, refer to Architect for decision before proceeding. Quantity or quality level shown or specified will be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.
   c. Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents. Where copies of standards are needed for performance of a required construction activity, Contractor will obtain copies directly from publication source.
   d. Trade Assoc. names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean associated names. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

B. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

C. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2013a.
C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2012.
D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
E. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2011.
F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009.

1.03 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 the Architect.
C. 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.
D. 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.
E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor 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).
I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 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.

1.05 SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

C. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

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

E. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.

i. Results of test/inspection.

j. Conformance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

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

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

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

H. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents. Reports shall include:

a. Name, address, and telephone number of technical representative making report.

b. Statement on condition of substrates and their acceptability for installation of product.

c. Statement that products at Project site comply with requirements.

d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

e. Results of operational and other tests and a statement of whether observed performance complies with requirements.

f. Statement whether conditions, products, and installation will affect warranty.

g. Other required items indicated in individual Specification Sections

I. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

4. Statement whether conditions, products, and installation will affect warranty.

5. Other required items indicated in individual Specification Sections.

J. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.06 CONTRACTOR'S QUALITY CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
   3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.07 TESTING AND INSPECTION AGENCIES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform specified testing and inspection. Contractor shall coordinate all testing. Owner shall employ and pay for Special Inspections as identified in Chapter 17 of the 2015 International Building Code.

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

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, and ASTM C1093.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in Oklahoma.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction 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, Owner and Contractor 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 and Owner, with copy to Contractor and to authorities having jurisdiction.
   4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   5. Retesting and reinspecting corrected work.
   6. Submitting a final report of special tests and inspections at Substantial Completion, which shall include descriptions of satisfactory resolutions achieved for all previously reported deficiencies.
B. Refer to the structural contract drawings for the list of structural items requiring special inspections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

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

3.02 MOCK-UPS

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

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

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

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

3.04 TESTING AND INSPECTION

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

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified. Reports shall state that tests conform to specified requirements or do not conform. It test does not conform to specified requirements, report shall state reason for failure.

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

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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

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

G. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct,

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

1. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

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

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4339
MOCK-UPS

PART 1 – GENERAL

1.01 SUMMARY

A. Mockup requirements. Mock-ups are required for, but not limited to the following:
   1. On-site exterior wall section sample panel, as indicted on Drawings.

B. All mock-ups specified herein, under other Sections of the Specifications, and shown on drawings will be reviewed and approved by the Architect and Owner. Unaccepted mock-ups shall be replaced or reconstructed in part or in total and the extent of the replacement or reconstruction shall be at the discretion of the Architect and Owner. The Contractor shall carry forth mock- up replacement or reconstruction until Architect's acceptance is obtained. Mock-up costs, including as many replacements or reconstruction as necessary to gain Architect's acceptance, shall be included in the Contract Cost and Schedule.

1.02 SUBMITTALS

A. Submit the following under provisions of Section 01 3300 – Submittal Procedures:
   1. Submit shop drawing of mockup indicating sizes, finishes and method of construction and installation of each component.

1.03 GENERAL

A. Where requested by Architect, or as specified in individual specification sections, assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes. Remove mock-up assemblies prior to date of Final Inspection, or as directed.

B. Mock-ups, when approved by the Architect, will be used as datum for comparison with the remainder of the Work for the purposes of acceptance or rejection. Maintain mockup throughout construction period until Substantial Completion or as otherwise directed by Architect.
   1. Approval of mock-ups and field samples do not constitute approval of deviations from the Contract Documents.
   2. Finishes, colors and textures of components shall be as specified for each component and shall be selected by the Architect.

C. Demolish and remove from site prior to requesting inspection for certification of Substantial Completion, all Mock-ups which are not permitted to remain as part of the finished work.

1.04 COORDINATION

A. Coordinate work of trades and schedule elements to expedite the fabricating, furnishing, and installation of multiple component mock-ups specified herein, in other Sections of the Specifications, and as shown in the Contract Documents.

PART 2 - PRODUCTS

2.01 EXTERIOR WALL SECTION MOCK-UP

A. Mockup Unit - General: Shall consist of one full size facsimile exterior wall section, as indicated on Elevation Sheets A201 & A202 using specified products as noted below. Mock-up shall be sized as indicated.

1. General description: Mockup Unit shall include exterior wall construction, with light gage steel stud framing backup and sheathing assembly. Mockup shall include all components specified and indicated which are typical to the exterior wall construction and additional components specified herein.
2. Building components used in mock-up may not be incorporated into the Work.
3. Finishes, colors and textures of components shall be as specified for each component and shall be selected by the Architect.

B. Major components to be included in the mockup include, but are not limited to the following. Provide all components and materials required for a complete weather-tight assembly as indicated and specified for the full building construction:

1. Section 03 3000 - CAST-IN-PLACE CONCRETE.
   a. Provide a concrete foundation wall to a depth required to support.
   b. Provide concrete structural components supporting mock-up as indicated, include architecturally finished exposed concrete surfaces.
2. Section 04 2000 - UNIT MASONRY.
   a. Provide type of brick and mortar specified, installed over sheathing with specified anchorage devices.
   b. Provide the various types of brick and mortars specified,
      1) Install brick over sheathing with specified anchorage devices and cavity insulation.
      2) Provide masonry ties, through-wall flashing, mortar netting, and weeps.
   c. Provide face brick in bond pattern, mortar color, and joint type to be used in the Work.
3. Section 04 4000 - STONE VENEER:
   a. Furnish stone veneer, in colors and finish specified.
4. Section 05 1200 – STRUCTURAL STEEL FRAMING: Include exterior struts and framing for scrim assembly, and miscellaneous framing components.
5. Section 05 4000 - COLD-FORMED METAL FRAMING:
   a. Provide cold formed metal stud framing with bracing as required for construction and support of the mockup panel.
6. Section 05 5213 – PIPE & TUBE RAILINGS:
   a. Provide railing system mock-up.
7. Section 06 1600 - GYPSUM SHEATHING:
   a. Install sheathing board, on exterior side of metal stud framing.
8. Section 07 1313 – BITUMINOUS SHEET WATERPROOFING:
   a. Provide shelf-adhered air barrier over sheathing and back-up components.
   b. Provide transition strips to abutting materials.
9. Section 07 5200 - MODIFIED BITUMINOUS MEMBRANE ROOFING:
   a. Provide non-insulated roofing system, with edging and flashings necessary to waterproof top of mock-up.
10. Section 07 9200 - JOINT SEALANTS:
    a. Provide joint sealant at perimeter of all components. Colors shall be selected by the Architect.
11. Section 08 1113 – HOLLOW METAL DOORS AND FRAMES:
    a. Provide exterior galvanized hollow metal door frame, with single operating door.

12. Section 08 7100 – DOOR HARDWARE:
    a. Provide door hardware set for exterior metal door and frame. Hardware to include lockset keyed with construction core, hinges and weather stripping.
13. Section 08 4413 – GLAZED ALUMINUM CURTAIN WALLS:
    a. Provide fixed glass type aluminum windows (cap glazed), and double-story height curtain wall system (structurally, 4-sided glazed) matching indicated curtain wall profiles and dimensions exactly.
    b. Framing to be custom shop finished to match matching Architect's control sample.
14. Section 08 8000 - GLAZING:
    a. Provide specified clear and tinted insulated glass into curtain wall framing. Provide spandrel glass (when specified) at interstitial space between floors. Confirm with Architect locations of all glass types.
15. Section 09 2900 - GYPSUM BOARD ASSEMBLIES:
    a. Install interior drywall related elements required in completed work including finishing of drywall.

PART 3 - EXECUTION

3.01 PREPARATION

A. Construct mock-ups at locations indicated or, if not indicated, at locations directed by the Architect.

B. Construct mockup in time to make product and/or assembly modifications without delaying production work.

3.02 INSTALLATION

A. Construct mockup to duplicate actual job conditions.
   1. Locate at an area on site as directed by the Architect.
   2. Provide foundations, bases, supports and braces adequate to make mockup stable and safe.

B. Provide weather protection for materials in mockups that are not exposed to weather in intended service.

3.03 REMOVAL

A. Retain mock-ups during construction as a standard for judging completed work until time designated by the Architect and the Owner,
   1. Completely demolish and remove mockups from the job site at time designated by Architect.
   2. Accepted mock-ups (which are specifically identified by the Architect to become part of the work) may be incorporated into the work provided they are not damaged during subsequent construction.

END OF SECTION

SECTION 01 4523
TESTING AND INSPECTION SERVICES

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

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

B. Construction Manager shall cooperate with the Testing Laboratory to facilitate performance of its work.

C. Refer to the Conditions of the Contract for provisions related to special inspections and testing.

D. Qualifications of Laboratory:

1. Meet requirements of ASTM C 1077, D 3666, D 3740, and E 543.
2. Authorized to operate in the State of Texas.

1.02 LABORATORY DUTIES

A. Cooperate with Architect and Construction Manager; provide qualified personnel after due notice.

B. Perform specified inspections, sampling, and testing of materials and methods of construction:

1. Comply with specified standards.
2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.

C. Promptly notify Architect and Construction Manager of observed irregularities or deficiencies of Work or products.

D. Promptly submit report of each test and inspection; submit one copy electronically in Adobe PDF format to Architect, Owner, and Construction Manager.

E. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing Laboratory name, address, and telephone number.
4. Name of Inspector and signature of individual in charge.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in project.
10. Type of inspection or test.
11. Results of tests and compliance or noncompliance with Contract Documents.
12. Interpretation of test results when requested by Architect or Construction Manager.

F. Perform additional tests when required by Architect or Construction Manager.

G. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of work.
3. Perform any duties of Construction Manager.

1.03 CONSTRUCTION MANAGER'S RESPONSIBILITIES

A. Cooperate with Laboratory personnel; provide access to Work, and to manufacturer's operations.

B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.

C. Furnish copies of product test reports as required.

D. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For safe storage and curing of test samples.

E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

F. When tests or inspections cannot be performed after such notice, reimburse Owner for Laboratory personnel and travel expenses incurred due to Construction Manager's negligence.

G. Make arrangements with Laboratory and pay for additional samples and tests required for Construction Manager's convenience.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Temporary utilities.
2. Field offices and sheds.
3. Temporary controls.
4. Protection of installed Work.
5. Security.
6. Progress cleaning.
7. Water, erosion, sediment, dust, and mold and mildew control.
8. Access roads and parking areas.
9. Removal.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.01 TEMPORARY ELECTRICITY

A. Provide temporary electrical service of capacity and characteristics required for construction.

B. Provide separate temporary electric service.

C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

D. Maintain distribution system and provide routine repairs.

3.02 TEMPORARY LIGHTING

A. Provide temporary lighting for construction and security purposes.

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

C. Maintain lamps and provide routine repairs.

D. Provide portable lights when required to provide minimum lighting levels necessary for specific work.

3.03 TEMPORARY HEAT

A. Provide temporary heating devices required to maintain specified ambient temperatures for construction.

B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless otherwise indicated in individual specification sections.

3.04 TEMPORARY VENTILATION

A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.

B. Provide temporary fan units as required to maintain clean air for construction.

3.05 TEMPORARY TELEPHONE AND COMPUTER SERVICES

A. Provide temporary telephone service required during construction.

B. Provide computer in Construction Manager's field office with printer, Internet access, scanner, and email service.

3.06 TEMPORARY WATER

A. Provide temporary water required for construction.

B. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.

C. Protect from freezing.

D. Maintain distribution system and provide routine repairs.

3.07 TEMPORARY SANITARY FACILITIES

A. Provide chemical toilets for use during construction.

B. Permanent toilets may not be used during construction.

C. Maintain facilities in clean and sanitary condition.

3.08 FIELD OFFICES AND SHEDS

A. Provide temporary field offices and storage sheds required for construction.

B. Do not unreasonably encumber site or premises with excess materials or equipment.

C. Temporary Structures:

1. Portable or mobile buildings, structurally sound, weathertight, with floors raised above ground.
2. Temperature transmission resistance: Compatible with occupancy and storage requirements.
3. Provide connections for utility services when required.
4. Provide steps and landings at entrances.

D. Field Office:

1. Size required for Construction Manager's use and to provide space for project meetings.
2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
3. Provide facilities for storage of Project Record Documents.
4. Provide thermometer mounted at convenient outside location, not in direct sunlight.

3.09 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect adjacent properties from construction operations.

B. Fencing:

1. Provide temporary fencing for construction operations.
2. Construction: Commercial grade chain link.

3. Height: 6 feet.
4. Locate to protect construction operations, materials, and equipment.
5. Provide vehicular gates.

C. Tree and Plant Protection:
1. Protect existing trees and plants at site that are designated to remain.
2. Remove roots and branches that interfere with construction.
3. Provide temporary barriers to height of 6 feet around individual or groups of trees and plants.
4. Do not permit vehicular traffic, parking, storage of materials, dumping of harmful chemicals or liquids, or standing or continuously running water within root zones.
5. Supervise earthwork operations to prevent damage to root zones.
6. Replace trees and plants that are damaged or destroyed due to construction operations.

3.10 EXTERIOR CLOSURES

A. Provide temporary weathertight closures for exterior openings to provide acceptable interior working conditions, to allow for temporary heating and maintenance of ambient temperatures required in individual specification sections, to protect the Work, and to prevent entry of unauthorized persons.

B. Provide access doors with locking hardware.

3.11 PROTECTION OF INSTALLED WORK

A. Protect installed work from construction operations; provide special protection when required in individual specification sections.

B. Minimize traffic, storage, and construction activities on roof surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from roofing manufacturer.

C. Prohibit traffic from landscaped areas.

3.12 SECURITY

A. Provide a project security program, to:
1. Protect the Work, stored products, and construction equipment from theft and vandalism.
2. Prevent entry by unauthorized persons.

3.13 PROGRESS CLEANING

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

B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.

C. Periodically clean interior areas to provide suitable conditions for finish work.

3.14 TEMPORARY CONTROLS

A. Water Control:
1. Grade site to drain. Prevent puddling water.
2. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
3. Provide water barriers to protect site from soil erosion.

B. Erosion and Sediment Control:
   1. Plan and execute methods to control surface drainage from cuts, fills, borrow areas, and waste disposal areas. Prevent erosion and sedimentation.
   2. Minimize amount of bare soil exposed at any one time.
   3. Provide temporary measures such as silt fences, dikes, berms, settlement basins, and drainage systems to prevent water flow and sedimentation.
   4. Periodically inspect earthwork to detect erosion and sedimentation; promptly employ corrective measures.
C. Dust Control:
   1. Provide dust control materials and methods to minimize dust from construction operations.
   2. Prevent dust from dispersing into atmosphere.
D. Mold and Mildew Control:
   1. Provide continuous measures to prevent formation of mold and mildew in construction.
   2. Do not install materials sensitive to mold and mildew growth until protection can be provided.
   3. Promptly remove and replace materials exhibiting mold and mildew growth.

3.15 ACCESS ROADS AND PARKING AREAS

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction needs.
B. Provide for access by emergency vehicles.
C. Keep fire hydrants and water control valves free from obstruction and accessible for use.
D. Provide parking facilities for construction personnel. When parking needs exceed on site capacity, provide additional off site facilities.

3.16 REMOVAL

A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.
B. Remove foundations and underground installations; grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore permanent facilities used during construction to original or to specified condition.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 PRODUCTS

A. Provide interchangeable components by the same manufacturer for identical items.

B. Do not use products containing asbestos or other known hazardous materials.

C. Do not reuse materials and equipment removed from existing construction in completed Work, except as specifically permitted by the Contract Documents.

1.02 TRANSPORTATION AND HANDLING

A. Coordinate delivery of Products to prevent conflict with Work and adverse conditions at site.

B. Transport and handle Products in accordance with manufacturer's instructions.

C. Promptly inspect shipments to ensure that Products comply with requirements of Contract Documents, are undamaged, and quantities are correct.

D. Provide equipment and personnel to handle products by methods to prevent damage.

1.03 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturer's instructions with manufacturer's seals and labels intact and legible.

B. Store Products on site unless prior written approval to store off site has been obtained from Owner.

C. Store Products subject to damage by elements in weathertight enclosures. Maintain temperature and humidity within ranges required by manufacturer's instructions.

D. Exterior Storage:

1. Store fabricated Products above ground; prevent soiling and staining.
2. Cover products subject to deterioration with impervious sheet coverings; provide ventilation to prevent condensation.
3. Store loose granular materials in well drained area on solid surfaces; prevent mixing with foreign matter.

E. Arrange storage areas to permit access for inspection. Periodically inspect stored products to verify that products are undamaged and in acceptable condition.

1.04 PRODUCT OPTIONS

A. Products specified by reference standard only:

1. Select any Product meeting the specified standard.
2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

B. Products specified by naming two or more acceptable Products: Select any named Product.

C. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":

1. Select the specified Product or a Product by a named manufacturer having equivalent or superior

characteristics to the specified Product and meeting the requirements of the Contract Documents.

2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
3. The specified Product establishes the required standard of quality.

D. Products specified by naming one or more Products followed by "or approved substitute" or similar statement:
   1. Submit a substitution request under provisions of Section 01 2500 for Products not listed.
   2. The specified Product establishes the required standard of quality.

E. Products specified by naming one or more Products or manufacturers followed by the statement "or approved equal":
   1. Submit a substitution request under provisions of Section 01 2500 for Products not listed.
   2. The specified Product establishes the required standard of quality.

F. Products specified by naming one Product followed by the statement "Substitutions: Not permitted": Substitutions will not be allowed.

G. Products specified by required performance or attributes, without naming a manufacturer or Product:
   1. Select any Product meeting specified requirements.
   2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 6400

OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS (OFCI)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Construction Drawings, Technical Specifications, Addenda, and general provisions of the Contract, including Contract General Conditions and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

0.01 SECTION INCLUDES

A. Requirements for installing Owner-furnished products, including providing miscellaneous items and accessories for a complete, functioning installation.

0.02 PRODUCT HANDLING

A. Protection: Contractor shall use means necessary to protect the materials of this Section before, during, and after installation and to protect completed Work, including products installed by others.

B. Replacements: In the event of damage, Contractor shall immediately repair all damaged and defective Work to satisfaction of Owner's Representative, at no change in Contract Time and Contract Sum.

PART 1 - PRODUCTS

1.01 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Products Identified with Contractor Responsibility for Installation:

1. Contractor shall verify mounting and utility requirements for accepted products.
2. Contractor shall provide mounting and utility rough-ins for OFCI products.
   a. Rough-in locations, sizes, capacities and similar type shall be as indicated and required by product manufacturers.
   b. If the Owner/Architect substitutes items similar to those scheduled there shall be no change in rough-in cost, unless substitution occurs after rough-in has been completed or rough-in involves other mounting requirements, utilities of different capacity than those required by item originally specified.
3. For items Designated to Be Owner- or Vendor-Furnished: Owner or its vendor will furnish manufacturer's literature or information, shop drawings, or appropriate information for preparing required shop drawings.

B. Installation Instructions: Approved manufacturer's printed descriptions, specifications and recommendations shall govern the Work, unless specifically indicated otherwise.

C. Electrical Components: Contractor shall comply with requirements specified in Division 16 - Electrical, including National Electrical Code (NEC).

D. Plumbing and HVAC Components: Contractor shall comply with requirements specified in Division 15 - Mechanical, including International Plumbing Code (IPC) and International Mechanical Code (IMC).

1.02 OWNER-FURNISHED/CONTRACTOR-INSTALLED PRODUCT REQUIREMENTS

A. Products Furnished by Owner and Installed by Contractor:

1. Contractor shall coordinate delivery of OFCI products. Owner will furnish products to coincide with construction schedule.

2. Owner will:
   a. Furnish standard integral components of products.
   b. Deliver products to site.
3. The Contractor shall:
   a. Receive products at site and give written receipt for product at time of delivery, noting visible defects and omissions; if such declaration is not given, the Contractor shall assume responsibility for such defects and omissions.
   b. Store products until ready for installation and protect from loss and damage.
   c. Uncrate, assemble and set products in place.
   d. Install products in accordance with manufacturer's recommendations, instructions and shop drawings under supervision of manufacturer's representative where specified, supplying labor and material required and making mechanical, plumbing and electrical connections necessary to operate equipment.
   e. Where so specified, installation shall be only by installer approved by manufacturer. If known, approved installer is identified on the Drawings or in the Specifications.
   f. Provide and install backing for all products weighing 20 pounds or more.

B. Products Furnished and Installed by Vendor:
1. Contractor prepare; vendor install:
   a. General: Contractor shall coordinate deliveries of vendor-supplied products. Vendor will furnish products to coincide with the construction schedule.
   b. Vendor will:
      1) Furnish standard integral components of products.
      2) Deliver products to site.
      3) Make connections to roughed-in utilities.
   c. Contractor shall:
      1) Receive products at site and give written notice of receipt of each product at time of delivery, noting visible defects.
      2) Provide rough-in of utility products in accordance with manufacturer's recommendations, instructions and shop drawings under supervision of the manufacturer's representative where specified.
      3) Provide and install backing for all products weighing 20 pounds or more.

PART 2 - EXECUTION

2.01 SURFACE CONDITIONS

A. Inspection:
1. Prior to commencing Work, Contractor shall verify that Work specified in other Sections has been properly completed and installed as specified to allow for installation of all materials and methods required of this Section.
2. Contractor shall verify that new and existing products and conditions are satisfactory for installation or relocation of OFCI products. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected.

B. Discrepancies:
   1. In the event of discrepancy, Contractor shall immediately notify the Owner's Representative.
   2. Contractor shall not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

2.02 INSTALLATION

A. Contractor shall relocate and reinstall existing products in accordance with Contract Documents and reviewed shop drawings, original manufacturer's instructions and recommendations if applicable and as directed.

B. Contractor shall install Owner-furnished products in accordance with reviewed shop drawings and manufacturer's printed instructions, as applicable.

2.03 ADJUSTING AND CLEANING

A. Contractor shall adjust products as necessary and as directed by Owner's Representative.

B. Contractor shall clean all new and relocated OFCI products.

C. Contractor shall protect OFCI products from damage until Contract Completion.

END OF SECTION

SECTION 01 7330
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 DEFINITION

A. “Cutting and Patching” is defined to include the cutting and patching of nominally completed and previously existing concrete, steel, wood and miscellaneous metal structures; piping and pavement, in order to accommodate the coordination of WORK, or the installation of other facilities or structures or to uncover other facilities and structures for access or inspection, or to obtain samples for testing, or for similar purposes.

1.02 REQUIREMENTS OF STRUCTURAL WORK

A. Structural WORK shall not be cut and patched in a manner that results in a reduction of load-carrying capacity or load/defection ratio.

B. Prior to cutting and patching the following categories of WORK, the CONTRACTOR shall obtain the ARCHITECT/ENGINEER’s approval to proceed with:

1. Structural steel
2. Miscellaneous structural metals, including equipment supports, stair systems and similar categories of WORK.
3. Structural concrete
4. Foundation construction
5. Timber and primary wood framing
6. Bearing and retaining walls
7. Structural decking
8. Exterior curtain wall construction
9. Pressurized piping, vessels and equipment
10. Asphalt pavement, concrete or asphalt curb/gutter, and concrete sidewalk.

1.03 OPERATIONAL AND SAFETY LIMITATIONS

A. The CONTRACTOR shall not cut and patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance or decreased safety.

B. Before cutting and patching the following categories of WORK, the CONTRACTOR shall obtain the ARCHITECT/ENGINEER’s approval to proceed with:

1. Sheeting, shoring and cross bracing
2. Operating systems and equipment
3. Water, moisture, vapor, air, smoke barriers, membranes and flashing
4. Noise and vibration control elements and systems
5. Control, communication, conveying and electrical wiring systems.

1.04 VISUAL REQUIREMENTS

A. The CONTRACTOR shall not cut and patch WORK which is exposed on the exterior or exposed in occupied spaces, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut and patch WORK, both as judged solely by the ARCHITECT/ENGINEER. The CONTRACTOR shall remove and replace WORK judged by the ARCHITECT/ENGINEER to have been cut and patched in a visually unsatisfactory manner.

1.05 APPROVALS

A. When prior approval for cutting and patching is required, the CONTRACTOR shall submit the request and obtain approval prior to performing the WORK. The request should include a description of why cutting and patching cannot reasonably be avoided; how it will be performed; how structural elements (if any) will be reinforced; products to be used; firms and tradespeople who will perform the WORK; approximate dates of the WORK; and anticipated results in terms of structural, operational, and visual variations from the original WORK.

PART 2 – PRODUCTS

2.01 MATERIALS USED IN CUTTING AND PATCHING

A. Unless otherwise indicated, the CONTRACTOR shall provide materials for cutting and patching which will result in an equal-or-better product than the material being cut and patched, in terms of performance characteristics and including visual effects where applicable. The CONTRACTOR shall use material identical with the original materials where feasible.

B. Materials shall comply with the requirements of the Technical Specifications wherever applicable.

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall provide adequate temporary support for WORK to be cut to prevent failure

B. The CONTRACTOR shall provide adequate protection of other WORK during cutting and patching.

3.02 INSTALLATION

A. The CONTRACTOR shall employ skilled tradespeople to perform cutting and patching. Except as otherwise indicated, the CONTRACTOR shall proceed with cutting and patching at the earliest feasible time and perform the WORK promptly.

B. The CONTRACTOR shall use methods least likely to damage WORK to be retained and WORK adjoining.

1. In general, where physical cutting action is required, the CONTRACTOR shall cut WORK with sawing and grinding tools, not with hammering and chopping tools. Openings through concrete WORK shall be core-drilled.
2. Comply with the requirements of Technical Specifications wherever applicable.
3. Comply with the requirements of applicable sections of Division 2 where cutting and patching requires excavation and backfill.

C. The CONTRACTOR shall patch with seams which are as invisible as possible and comply with specified tolerance for the WORK.

D. The CONTRACTOR shall restore exposed seams of patched area; and, where necessary, extend finish restoration onto retained WORK adjoining, in a manner, which will eliminate evidence of patching.

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for:
   1. Disposing of nonhazardous demolition and construction waste.
B. Related Requirements:
   1. Section 02 4120 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   2. Site Clearing requirements for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
C. Disposal: Removal off-site of demolition and construction waste & subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
E. Salvage: Recovery of demolition or construction waste & subsequent sale or reuse in another facility.
F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, & other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 01 5000 "Temporary Facilities and Controls."

3.02 DISPOSAL OF WASTE

A. General: Remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Burning: Do not burn waste materials.
C. Disposal: Remove waste materials from Owner's property and legally dispose of them.
D. Removal and disposal of construction waste shall be coordinated with a City approved vendor.

END OF SECTION

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 CLOSEOUT PROCEDURES

A. Final Inspection:
   1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's inspection.
   2. If Architect performs re-inspection due to failure of Work to comply with claims of status of completion made by Construction Manager, Owner will compensate Architect for such additional services and will deduct the amount of such compensation from final payment to Construction Manager.

B. Submit final Application for Payment showing original Contract Sum, adjustments, previous payments, retainage withheld from previous payments, and sum remaining due.

C. Closeout Submittals:
   1. Evidence of compliance with requirements of governing authorities.
   2. Certificate of Occupancy.
   3. Project Record Documents.
   4. Operation and Maintenance Data.
   5. Warranties.
   6. Keys and keying schedule.
   7. Spare parts and maintenance materials.
   8. Evidence of payment of Subcontractors and suppliers.
   9. Final lien waiver.
   10. Certificate of insurance for products and completed operations.
   11. Consent of Surety to final payment.

1.02 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean surfaces exposed to view:
   1. Clean glass.
   2. Remove temporary labels, stains and foreign substances.
   3. Polish transparent and glossy surfaces.
   4. Vacuum carpeted surfaces; damp mop hard surface flooring.

C. Clean equipment and fixtures to a sanitary condition.

D. Clean or replace filters of operating equipment.

E. Clean debris from roofs and drainage systems.

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

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.03 ADJUSTING

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

1.04 PROJECT RECORD DOCUMENTS

A. Maintain following record documents on site; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Material Safety Data Sheets.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Make entries neatly and accurately.

E. Label each set or volume with "PROJECT RECORD DOCUMENTS", project title, and description of contents.
   1. Organize contents according to Project Manual Table of Contents.
   2. Provide Table of Contents for each volume.

F. Drawings: Mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Drawings.

G. Specifications: Mark each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.

H. Shop Drawings: Mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Shop Drawings.

I. Material Safety Data Sheets:
   1. Maintain copies of manufacturer's Material Safety Data Sheets for each Product incorporated into the Work.
   2. Indicate manufacturer name, product name, chemical composition, hazards, and safety and health procedures.

J. **Submit one set of marked-up record prints, one set of record transparencies, and one set of PDF electronic files. Print each drawing, whether or not changes and additional information were recorded. along with final Application for Payment.**

1.05 OPERATION AND MAINTENANCE DATA

A. Identify as "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.

B. Contents:

1. Directory: List names, addresses, and telephone numbers of Architect, Construction Manager, Subcontractors, and major equipment suppliers.

2. Operation and maintenance instructions: Arranged by system and subdivided by specification section.

   For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

   a. Significant design criteria.

   b. List of equipment.

   c. Parts list for each component.

   d. Operating instructions.

   e. Maintenance instructions for equipment and systems.

   f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

3. Project documents and certificates including:

   a. Shop drawings and product data.

   b. Air and water balance reports.

   c. Certificates.

   d. Copies of warranties and bonds.

C. Submittal:

1. Submit electronically in Adobe PDF format at least 15 days prior to final inspection.

2. Architect will notify Construction Manager of any required revisions after final inspection.

3. Revise content of documents as required prior to final submittal.

4. Submit electronically in Adobe PDF format within 10 days after final inspection

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1.06 WARRANTIES

A. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

B. Include Table of Contents.

C. Submit electronically in Adobe PDF format along with final Application for Payment.

D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.08 STARTING OF SYSTEMS

A. Notify Owner and Architect at least seven days prior to startup of each system or piece of equipment.

B. Prior to beginning startup verify that:
   1. Lubrication has been performed.
   2. Drive rotation, belt tension, control sequences, tests, meter readings, and electrical characteristics are within manufacturer's requirements.
   3. Utility connections and support components are complete and tested.
C. Execute start-up under supervision of applicable manufacturer's representative or Construction Manager's personnel in accordance with manufacturers' instructions.
D. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.
E. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.09 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.
E. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 7823
OPERATING AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section specifies the administrative requirements, procedural obligations, terms and conditions and general requirements related to the preparation and submittal of instruction manuals covering the materials installed, care, preservation and maintenance of products, finishes, equipment & systems.

B. Related Sections:

1. Special operating and maintenance data requirements for specific equipment or building operating systems are included in the appropriate Specifications Sections of Divisions 02 through 33.
2. Preparation of Shop Drawings and Product Data are included in Specification Section 01 3300, "Submittal Procedures".
3. General closeout requirements are included in Specification Section 01 7700, "Closeout Procedures".
4. General requirements for submittal of Project Record Documents are included in Section 01 7839, "Project Record Documents".

1.02 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals:

1. Submit two (2) copies of the first and subsequent drafts of each manual for review. Include a complete index and table of contents for each volume. One (1) copy will be returned within 45 days of receipt with comments. The first draft shall be at least 95% complete. Provide FINAL manuals prior to commencement of training; these manuals shall be utilized as instructional text during the building orientation and training processes. Refer to Section 01 7900 – Demonstration and Training.

B. Form of Submittal: Manuals should be prepared in the form of an instructional manual for use by the Owner's operating personnel and/or property management company. The information should be bound as follows:

1. Binders: For each manual, provide heavy-gauge, commercial quality, vinyl hanging presentation binders in 3" capacity sized to receive 8-1/2" by 11" paper. Binder color shall be white.
   a. Identify each binder on the spine with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", project name and subject matter covered.
   b. Indicate the volume number for multiple volume sets of manuals.
2. Dividers: Manual contents shall be organized and divided by specification divisions using index maker dividers.
3. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
4. Text Material: Where written material is required as part of the manual, use the manufacturers standard printed material.
5. Drawings: Where drawings or diagrams are required as part of the manual, provide protective plastic jackets for the drawings and bind in with the text.

1.03 GENERAL MANUAL CONTENT

A. In each manual, include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:
   1. General system or equipment description.
   2. Design factors and assumptions.
   3. Copies of approved shop drawings, product data, installation instructions and setup/calibration procedures.
   4. Load and performance testing reports including equipment and system startup/performance documentation.
   5. Fire/flame spread test certificates.
   6. System or equipment identification, including:
      a. Name of manufacturer
      b. Model number
      c. Serial number
   7. Standard operating instructions.
   8. Emergency operating instructions.
   9. Wiring diagrams including color coding, labeling and terminal designations.
   10. Inspection and test procedures.
   11. Detailed preventative maintenance procedures, frequencies and special tool requirements.
   12. Operator trouble-shooting guide.
   13. Precautions against improper use and maintenance.
   14. Copies of warranties, including extended warranty options.
   15. General owners operating/service manual.
   16. Factory service manuals, including repair instructions and illustrated parts listing.
   17. Electronic copies of operating system software (CD-ROM).
   18. Material safety data sheets.
   19. Sources of required maintenance materials repair/replacement parts and related services.
   20. Copies of inspections and certifications by governing authorities.

B. Manual Index: Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service contract proposal.

C. Title Page: Provide a title page as the first sheet of each manual. Provide the following information.
   1. Subject matter covered by the manual.
   2. Name and number of the Contract.
   3. Date of submittal.
   4. Name, address, and telephone number of the Contractor and Subcontractor.
   5. Name and address of the Architect/Engineer.
   6. Cross reference to related systems in other operating and maintenance manuals.

D. General Table of Contents: After the Title Page, include a typewritten table of contents for each volume (Divisions 02 through 33 inclusive), arranged according to the specification format.

E. General Information: Provide a general information Section immediately following the Table of Contents, listing by Specification Section each major product included in the manual, identified by product name. Under each product, list the name, address, telephone number, and point of contact of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.

F. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.

1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
   a. Manufacturer's Catalog Number
   b. Size
   c. Material Composition
   d. Color
   e. Texture
   f. Re-ordering Information for Specially Manufactured Products
2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
3. Color Schedules: Provide information showing manufacturer's color name and catalog number for all exposed finishes, including paint, carpet, wallcoverings, and other finish materials.
4. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.
   a. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
      1) Applicable standards
      2) Chemical composition
      3) Installation details
      4) Inspection procedures
      5) Maintenance information
      6) Repair procedures

G. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:
   a. Equipment or system function
   b. Operating characteristics
   c. Limiting conditions

d. Performance curves
e. Engineering data and tests
f. Complete nomenclatures and number of replacement parts

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:
   a. Printed operating and maintenance instructions.
   b. Assembly drawings and diagrams required for maintenance.
   c. Recommended parts inventory listing.
3. Provide information detailing essential maintenance procedures, including the following:
   a. Routine operations
   b. Trouble-shooting guide
   c. Disassembly, repair and reassembly
   d. Alignment, adjusting and checking
4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
   a. Start-up procedures
   b. Equipment or system break-in
   c. Routine and normal operating instructions
   d. Regulation and control procedures
   e. Instructions on stopping
   f. Shut-down and emergency instructions
   g. Day and night operating instructions
   h. Summer and winter operating instructions
   i. Required sequences for pneumatic, electric, electronic or direct digital control systems
   j. Special operating instructions
5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a comprehensive description of the sequence of operation and as installed control diagrams by the control manufacturer for systems requiring controls.
7. Drawings: Provide copies of each Contractor/Subcontractor set of coordination drawings.
8. Valve Tags: Provide charts of valve tag numbers with the room number location and function of each valve. Valve tag locations shall be clearly indicated on the set of record "As-Built" drawings.
9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:
   a. Electric power
   b. Lighting
   c. Communications
   d. Fire Alarm

H. Written Test: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures.

Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.

I. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation. Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.

J. Warranties, Bonds, and Service Contracts: Provide a photocopy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure including the return policies/procedures. List circumstances and conditions that would affect validly of the warranty or bond. Commencement and expiration dates shall be clearly indicated.

K. Provide complete information in the manual on products specified in Divisions 02 through 33.

1.04 TRAINING OF OPERATING AND MAINTENANCE PERSONNEL

A. Prior to final inspection, instruct the maintenance personnel in operation, adjustment, and maintenance of products, equipment and systems as required per Section 01 7900 – Demonstration and Training.
   1. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

1.05 OPERATING MAINTENANCE MANUALS

A. Submit copies of each manual, in the form specified, to the Owner's Representative for distribution.
   1. Refer to individual Specification Sections and other paragraphs within this Section for additional requirements.

B. Manuals should be organized into separate and distinct volumes (binders) as described hereafter:
   1. "SITE WORK"
      a. Asphalt Concrete Pavement
      b. Tack and Prime Coat
      c. Concrete Curbs and Sidewalks
      d. Pavement Markings
      e. Guide Rail
      f. Termite Control
      g. Traffic Signage
   2. "SITE WORK UTILITIES"
      a. Water and Sanitary Sewer Facilities
      b. Drainage Structures
      c. Underdrains
      d. Electrical Power Service
      e. Gas Utility
   3. "Landscape and Site Improvements"
      a. Soil Preparation and Seeding
      b. Trees, Plants, and Ground Cover

c. Fences and Gates
d. Playfields and Equipment
e. Site and Street Furnishings

4. "BUILDINGS AND STRUCTURES"
   a. Concrete
   b. Unit Masonry
   c. Metals
   d. Woods and Plastics
   e. Thermal and Moisture Protection
   f. Doors and Windows
   g. Finishes
   h. Specialties
   i. Fixtures, Furnishings, and Equipment
5. "MECHANICAL, HVAC"
   a. Basic Materials and Methods
   b. Piping and Specialties
   c. Insulation
   d. Pumping
   e. Refrigeration
   f. Air Handling and Distribution
   g. Automatic Temperature Control
   h. Testing/Adjusting/Balancing
6. "MECHANICAL, PLUMBING"
   a. Basic Materials and Methods
   b. Piping and Specialties
   c. Insulation
   d. Fixtures/Trim/Accessories
   e. Water Heaters
   f. In-Line Circulating Pumps
   g. Water Softening Equipment
7. "FIRE SPRINKLERS"
   a. Basic Materials and Methods
   b. Standpipe and Hose Systems
   c. Fire Pumps
   d. Dry Pipe Sprinkler Systems
   e. Wet Pipe Sprinkler Systems
8. "ELECTRICAL"
   a. Basic Materials and Methods
   b. Service and Distribution
      1) Service Entrance
      2) Switchboards
      3) Disconnects

4) Grounding
5) Transformers
6) Panelboards
7) Overcurrent Protective Devices
8) Contactors
9) Voltage Surge Suppression
10) Heat Tracing

c. Lighting
1) Interior and Exterior Luminaries, Lamps and Accessories
2) Emergency Lighting
3) Lighting Control Equipment

9. "SOUND SYSTEMS"
10. "COMMUNICATIONS"
a. Voice and Data
b. Television Distribution System
c. Security Intercom System
11. "FIRE ALARM SYSTEM"

1.06 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store Record Documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition. Make Documents and Samples available at all times for inspection by the Owner's Representative or Architect.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 7839
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This Section specifies administrative and procedural requirements for Project Record Documents to be prepared and submitted by the General Contractor.
   2. Project Record Documents required include:
      a. Marked-Up Copies of Record Drawings, Specifications, and Product Data
      b. Record Samples
      c. Miscellaneous Record Submittals

B. Related Sections:
   1. General project closeout requirements are included in “Closeout Procedures”, Section 01 7700.
   2. General requirements for submittal of Shop Drawings and Product Data are included in General Conditions and the Section “Submittal Procedures,” Section 01 3300.
   3. Specific record copy requirements that expand requirements of this Section are included in the individual Sections of Divisions 02 through 33.
   4. Operating and maintenance data is specified in Section 01 7823.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain at the jobsite one copy of the following documents for record purposes:
   1. Conformed Contract Documents. One set of full size prints shall be maintained for recording as-built revisions and special features.
   2. Change Orders
   3. Approved Submittals
   4. Clarifications or Explanatory Details and Specifications.
   5. Inspection Reports
   6. Laboratory Test Records
   7. Field Test Reports and Records
   8. Factory Test Reports and Records

B. Maintain for record purposes at a location approved by the Architect, electronic files for those shop drawings and other documents which are required to be submitted electronically, ensure that backups of electronic files are made on a regular basis and stored at a remote location.

C. Store Documents used for record purposes in the Contractor’s field office or other approved location, apart from documents used for construction. Do not use record documents for construction or fabrication purposes.

D. Provide file and racks for storage of documents.

E. File documents in accordance with filing format of the contract specifications, by section number and title.

F. Maintain documents in clean, dry, legible condition.

G. Label each document “Project Record”.

H. Make documents available at all times for inspection by the Architect/Engineer. Make copies of electronic documents upon Architect's / Engineer's request.

1.03 RECORD DRAWINGS

A. The Contractor shall maintain a white-print set (blue-line or black-line) of Contract Drawings and Shop Drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where Shop Drawings are used for mark-up, record a cross reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either Contract Drawings or Shop Drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each set.

B. Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, Subcontractor, or similar entity, is required to prepare the mark-up on Record Drawings.

C. At time of Substantial Completion, submit Record Drawings to Owner for Owner's records in accordance with Project Closeout Requirements.

1. Refer to Section 01 7823 for items to be included in manuals.
2. Three (3) copies will be required.

1.04 RECORD SPECIFICATIONS

A. The Contractor shall maintain one copy of specifications, including addenda, change orders, and similar modifications issued in printed form during construction, and mark-up variations (of substance) in actual work in comparison with text of specifications and modifications as issued. Give particular attention to substitutions, selection of option, and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable. Upon completion of mark-up, submit to Architect.

1. The Contractor is responsible for collecting marked-up record Sections from each of the other Subcontractors, and for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications. Submit to the Owner, Three (3) copies will be required.

1.05 PRODUCT DATA

A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.

1. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation.
2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
3. Note related Change Orders and mark-up of Record Drawings, where applicable.

4. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data. Refer to Section 01 7823 for requirements. Submit to Owner.
5. The Contractor is responsible for mark-up & submittal of record Product Data.

1.06 SAMPLES

A. Immediately prior to date of Substantial Completion, the Contractor shall meet with the Owner at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Owner's instructions for packaging, identification marking, and delivery to Owner's storage space. Dispose of other Samples in manner specified for disposal of surplus and waste materials.

1.07 MISCELLANEOUS RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Owner.
1. Categories of requirements resulting in miscellaneous records include, but are not limited to, the following:
    a. Field Records on Excavations and Foundations
    b. Field Records on Underground Construction and Similar Work
    c. Survey Showing Locations and Elevations of Underground Lines
    d. Invert Elevations of Drainage Piping
    e. Surveys Establishing Building Lines and Levels
    f. Authorized Measurements Utilizing Unit Prices or Allowances
    g. Batch Mixing and Bulk Delivery Records
    h. Load and Performance Testing
    i. Inspections and Certifications by Governing Authorities
    j. Leakage and Water-Penetration Tests
    k. Fire Resistance and Flame Spread Test Results
    l. Final Inspection and Correction Procedures

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 RECORDING

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be operated and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Electrical systems and equipment.
   4. Fire Alarm and Fire Sprinkler systems.
   5. Plumbing system - Location of valves for turning off various locations throughout the building, Including location of main cutoffs at the building and at the street. Location of backflow prevention devices.
   6. Landscape Irrigation systems – Setup and controls.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring, wall finishes, and ceiling finishes.

1.02 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for submittal requirements; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for operating purposes, directly to the Facility Manager.
   2. Submit one copy to the Facility Manager, not to be returned.
   3. Provide operating submittals on time schedule specified by the Facility Manager.
   4. Submittals indicated as "Draft" are intended for the use of the Facility Manager in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Facility Manager for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.

g. Media to be used, such a slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by Facility Manager.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Facility Manager and Owner will review the Training Plan based on draft plans developed and submitted by Contractor.

B. Conduct training on-site unless otherwise indicated.
C. Owner will provide classroom and seating at no cost to Construction Manager.
D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
E. Provide training in minimum two hour segments.
F. The Facility Manager is responsible for determining that the training was satisfactorily completed and will provide approval forms.
G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Construction Manager for personnel "show-up" time.
H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
    1. The location of the O&M manuals and procedures for use and preservation; backup copies.
    2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
    3. Typical uses of the O&M manuals.
I. Product- and System-Specific Training:
    1. Review the applicable O&M manuals.
    2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
    3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
    4. Provide hands-on training on all operational modes possible and preventive maintenance.
    5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
    6. Discuss common troubleshooting problems and solutions.
    7. Discuss any peculiarities of equipment installation or operation.
    8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
    9. Review recommended tools and spare parts inventory suggestions of manufacturers.
    10. Review spare parts and tools required to be furnished by Construction Manager.
    11. Review spare parts suppliers and sources and procurement procedures.
J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 4120
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Removal of designated paving, building construction, equipment, and fixtures.
2. Identification of utilities.

1.02 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structures, and dust control.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Conform to applicable codes when hazardous or contaminated materials are discovered.

E. Do not close or obstruct exits.

F. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

1.03 PROJECT CONDITIONS

A. Minimize interference with streets, walks, public right-of-ways, and adjacent facilities.

B. If hazardous materials are discovered, notify Architect and await instructions.

C. If any of the following conditions are encountered, cease work immediately, notify Architect, and await instructions:

1. Structure is in danger of movement or collapse.
2. Materials or conditions encountered differ from those designated in the contract documents.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.01 PREPARATION

A. Erect temporary partitions, barricades, warning devices, and controls.

B. Provide protective coverings, shoring, bracing, and supports for construction designated to remain.

C. Temporarily or permanently disconnect utilities as required.

3.02 DEMOLITION

A. Remove existing paving & construction to extent indicated and as necessary to join new work to existing. Do not remove more than is necessary to allow for new paving or construction.

B. Do not damage work designated to remain.

C. Minimize noise and spread of dirt and dust.

D. Assign work to trades skilled in procedures involved.

E. Plug ends of disconnected utilities with threaded or welded caps.

F. Protect and support active utilities designated to remain. Post warning signs showing location and type of utility and type of hazard.

G. Store items designated to remain property of Owner where directed by Owner.

H. Remove and dispose of waste materials off site.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Diagram of proposed construction joints not indicated on drawings.

1.02 QUALITY ASSURANCE

A. Design formwork in accordance with ACI 301 and 347.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Form Accessories:
   1. Burke by Edoco. (www.burkebyedeco.com)
   2. Conspec Marketing and Manufacturing. (www.conspecmkt.com)
   3. Dayton/Richmond. (www.daytonrichmond.com)
   4. Greenstreak, Inc. (www.greenstreak.com)
   5. Nox-Crete Products Group. (www.nox-crete.com)

2.02 MATERIALS

A. Forms:
   1. Wood, reusable metal, reusable glass fiber, or other approved material that will not adversely affect surface of concrete & will provide or facilitate obtaining specified surface finish.
   2. Wood:
      a. Concealed surfaces:
         1) Lumber, No. 2 Common or better, dressed to smooth contact surfaces, or:
         2) APA Rated Plyform Structural I.
      b. Exposed surfaces: Non absorptive medium density overlay plywood.
   3. Metal: Minimum 16 gage steel, tight fitting, stiffened to support concrete.

2.03 ACCESSORIES

A. Form Ties: Snap off type, adjustable length, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete.
B. Form Release Agent: Non-staining, colorless mineral oil that will not absorb moisture, stain concrete, or impair adhesion of coatings to be applied to concrete.
C. Construction Joints Forms: Formed galvanized steel, minimum 18 gage, with keyway.
D. Anchors and Fasteners: Size as required, sufficient strength to maintain forms in place while concrete is placed.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Construct formwork, shoring, and bracing to produce concrete of required shape, line, and dimension.
B. Arrange and assemble formwork with minimum joints, located to allow dismantling without damage to concrete.
C. Make joints watertight.

D. Provide chamfer strips in corners of forms to produce beveled external corners.
E. Camber formwork to compensate for deflection during concrete placement.
F. Adjust supports to take up settlement caused by concrete placement.
G. Provide temporary openings in formwork to allow cleaning and observation; locate at bottom of forms. Close with tight fitting panels flush with face of forms.
H. Construct forms for beams and girders so that sides may be removed without disturbing bottom of form or its support.
I. Clean contact and screed surfaces prior to concrete placement.
J. Construction Joints:
    1. Unless otherwise indicated on drawings, each unit of construction is a single unit; place concrete continuously to provide monolithic construction.
    2. Obtain Architect's approval of construction joint locations not indicated on drawings.
    3. Provide keys and dowels in joints.
    4. Use construction joint form for joints in floor slabs. Set screed edge at required elevation. Secure to prevent movement.
K. Form Release Agent:
    1. Apply form release agent to formwork prior to placing reinforcing, anchoring devices, and embedded items; follow manufacturer's instructions.
    2. Do not allow agent to puddle in forms or to contact hardened concrete against which fresh concrete is to be placed.
L. Inserts and Embedded Parts:
    1. Before concrete is placed, install inserts, anchor slots, anchor bolts, and embedded parts required for attachment of work.
    2. Provide formed openings where required for pipes, conduits, sleeves, and other work passing through concrete members.
    3. Maintain in position during concrete placement.
M. Form Removal:
    1. Do not remove formwork until concrete has attained sufficient strength to resist dead loads plus applied live loads.
    2. Remove formwork in manner that will not damage surfaces of concrete; patch work damaged during form removal operations.
    3. Provide shoring, reshoring, and bracing as required.
N. Installation Tolerances: Construct formwork to maintain tolerances required by ACI 301.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Include bar sizes, spacings, laps, locations, and quantities of reinforcing bars, welded wire reinforcement (WWR), and accessories. Welded Wire Reinforcement (WWR) to be included on shop drawings and rebar material call-outs.
   2. Provide bending and cutting schedules.
   3. Show complete layout plan for each layer of reinforcing.

1.02 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcing to project site in bundles marked with tags indicating bar size, length, and mark.
B. Store reinforcing above ground in dry, well drained area; protect from corrosion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars:
   1. ASTM A615/A615M, deformed billet steel, Grade 60.
   2. Finish: Plain.
B. Welded Wire Reinforcement:
   1. ASTM A185/A185M. Furnish in flat sheets.
   2. Finish: Plain.

2.02 ACCESSORIES

A. Spacers, Chairs, Bolsters, and Bar Supports:
   1. Sized and shaped for strength and support of reinforcement during concrete placement.
   2. Galvanized or plastic coated steel for surfaces exposed to weather.
B. Tie Wire: Annealed steel, minimum 16 gage.

2.03 FABRICATION

A. Fabricate in accordance with ACI 301 and CRSI Manual.
B. Bend bars cold; do not heat or bend by makeshift methods. Discard damaged bars.
C. Welding: AWS D1.4.
D. Fabrication Tolerances:
   1. Sheared length: Plus or minus 1 inch.
   2. Bends in stirrups and ties: Plus or minus 1/2 inch.
   3. All other bends: Plus or minus 1 inch.

PART 3 EXECUTION

3.01 PREPARATION

A. Before placing in work, thoroughly clean reinforcing of loose rust, mill scale, dirt, oil, and other materials that could reduce bonding.
B. Inspect reinforcing left protruding for future bonding or following delay in work, and clean if necessary.

3.02 INSTALLATION

A. Install reinforcing in accordance with ACI 301, and CRSI Manual and Publications 63 and 65.

B. Accurately position reinforcing; securely tie at intersections.

C. Welding: AWS D1.4.

D. Install wire fabric reinforcing in longest practical lengths. Offset end laps in adjacent widths to prevent continuous lap.

E. Do not displace or damage vapor retarder. (Refer to Section 07 2600 for 15 mil Vapor Retarder).

F. Locate splices not indicated on drawings at points of minimum stress.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SUBMITTALS

A. Concrete Mix Designs: Submit in accordance with Section 01 3300 - Submittal Procedures Include:
   1. Proportions of cement, fine and coarse aggregates, and water.
   2. Combined aggregate gradation.
   3. Aggregate specific gravities and gradations.
   4. Water/cement ratio, design strength, slump, and air content.
   5. Type of cement and aggregates.
   6. Type and proportion of admixtures.
   7. Special requirements for pumping.
   8. Range of ambient temperature and humidity for which design is valid.
   9. Special characteristics of mix requiring precautions in mixing, placing, or finishing techniques to achieve finished product.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Comply with the applicable provisions of the following codes, specifications, and standards:
   1. ACI 301 “Specifications for Structural Concrete for Buildings.”
   2. ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.”
   3. ACI 311 “Recommended Practice for Concrete Inspection.”
   4. ACI 318 “Building Code Requirements for Reinforced Concrete.”
   5. ACI 347 “Recommended Practice for Concrete Formwork.” Concrete Reinforcing Steel Institute, “Manual for Standard Practice.”

B. Workmanship: Contractor is responsible for correction of concrete work which does not conform to the specified requirements, including strength, tolerance, and finishes. Correct deficient unsatisfactory concrete as directed by Engineer.

C. Provide testing and inspection service for quality control testing during concrete operations in accordance with General Conditions.

1.03 DELIVERY, STORAGE AND HANDLING

A. Mix and deliver concrete to project ready mixed in accordance with ASTM C 94.

B. Schedule delivery so that pours will not be interrupted for over 15 minutes.

C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

1.04 PROJECT CONDITIONS

A. Cold Weather Placement - Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Comply with ACI 306R and following requirements:
   1. Air temperature at or expected to fall below 40 degrees F, uniformly heat water and aggregates Before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

B. Hot Weather Placement - Place concrete in accordance with ACI 305R and following requirements:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Use chilled mixing water or chopped ice if water equivalent of ice is calculated in total amount of mixing water.
2. If required, cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature.
3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Concrete Chemicals:
1. Burke by Edoco. (www.burkebyedeco.com)
2. Conspec Marketing and Manufacturing. (www.conspecmkt.com)
3. Curecrete Distribution, Inc. (www.ashfordformula.com)
4. Dayton/Richmond. (www.daytonrichmond.com)
5. BASF Admixtures, Inc. (www.masterbuilders.com)
6. W. R. Meadows, Inc. (www.wrmeadows.com)
7. Nox-Crete Products Group. (www.nox-crete.com)

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or III, gray color.

B. Aggregates:
1. Fine: ASTM C 33, clean, hard, durable, uncoated natural sand, free from silt, loam, and clay.
2. Coarse: ASTM C 33, clean, hard, durable, uncoated crushed stone, maximum size No. 467, Table No. 2.

C. Fly Ash: ASTM C 618, maximum 2 percent loss on ignition.

D. Calcium chloride or admixtures containing more than 0.1% chloride ions, are not permitted.

2.03 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable size to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use plywood complying with U.S. Product Standards PS-1 “B-B High Density Overlaid Concrete Form,” Class 1.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

2.04 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60.

B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs and spacers, supporting, and fastening reinforcing bars in place. Use wire bar type supports complying with CRSI recommendations. Wood, brick, plastic, and other devices will not be acceptable.

2.05 ACCESSORIES

A. Water: Clean and potable, free from oil, acid, organic matter or other deleterious substances.

B. Admixtures:

1. Water reducing or water reducing/set retarding: ASTM C 494, Type A or D.
2. Air entraining: ASTM C 260.
3. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and contain not more than 0.1% chloride ions.

C. Expansion Joint Filler: ASTM D 1752, non-asphaltic type.

D. Non Shrink Grout: Premixed, consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; minimum 7,000 psi compressive strength at 28 days.

E. Bonding Agent: Two component modified epoxy resin.

F. Curing Compound: ASTM C 309, water based type.

G. Curing Paper: ASTM C 171, waterproof paper or polyethylene film.

H. Cure-Seal-Hardener: Consolideck LS as manufactured by ProSoCo, Inc. Subject to compliance with requirements, provide basis of design product or comparable by one of the following:

1. Curecrete Company.
2. WR Meadows.

2.06 MIXES

A. Proportions: In accordance with ACI 301.

B. Design concrete to yield characteristics indicated on drawings.

C. Air Entrained Concrete: Provide air entraining admixture to produce 4 to 6 percent air by volume of concrete.

D. Use accelerating admixture in cold weather only when approved by Architect. Use of admixtures will not reduce cold weather placement requirements.

E. Fly Ash Content: 25 percent by weight of cementitious material in mix.

2.07 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mix for concrete, to produce a minimum 28 day compressive strength of 3,000 psi, as indicated on Contract Documents. Use an independent testing facility acceptable to the Architect for preparing and reporting proposed mix designs.

B. Proportion mixes by laboratory trial batch, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1.

C. Submit written reports to the Architect of each proposed mix for each class concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by the Architect/Engineer.

D. Admixtures:

1. Use air-entraining admixture in exterior exposed concrete. Add air-entraining admixture at the

manufacturer's prescribed rate to result in concrete at the point of placement having air content of 5% (±1%) with a maximum water cement ratio of 0.50.

E. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement of not less than 3" and not more than 5".

PART 3 EXECUTION

3.01 FORMS

A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces.

E. Chamfer exposed corners and edges as shown, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniforms smooth lines and tight edge joints.

F. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Provide ties so portion remaining within concrete after removal is at least 1½" inside concrete and which will not leave holes larger than 1" diameter in concrete surface.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and locations of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate leaks.

I. Forms which are destroyed or damaged and are not capable of supporting the design load shall be replaced with new forms prior to placing concrete.

3.02 PREPARATION

A. Notify Architect and Testing Laboratory minimum 24 hours prior to placing concrete.

B. Accurately position anchor bolts, sleeves, conduit, inserts, and accessories. Do not cut reinforcing steel to facilitate installation of inserts or accessories.

C. Remove water and debris from forms and excavations.

D. Close openings left in forms for cleaning and inspection.

E. Prepare previously placed [and existing] concrete surfaces by cleaning with steel wire brush and applying bonding agent in accordance with manufacturer's instructions.

F. Where new concrete is doweled to existing, drill holes in existing concrete, insert steel dowels, and pack holes solid with non-shrink epoxy grout.

3.03 PLACING REINFORCEMENT

A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers.

D. Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.04 JOINTS

A. Construction Joints: Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the Engineer.

B. Provide keyways at least 1½" deep in all construction joints in grade beams.

C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.

D. Control Joints per details.

3.05 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screeds required. Align the concrete surface to the elevation of the screed strips by the use of strike-off templates.

3.06 PREPARATION OF FORM SURFACES

A. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 PLACEMENT OF CONCRETE

A. Pre-Placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work. Thoroughly wet wood forms immediately before placing concrete, where form-coatings are not used. Notify the Architect/Engineer at least one (2) working days prior to concrete placement.

B. Place concrete in accordance with ACI 301 and ACI 318.

C. Ensure reinforcement, inserts, and embedded parts are not disturbed during concrete placement.
D. Deposit concrete as nearly as possible in its final position to minimize handling and flowing.
E. Placing Concrete: Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
F. Do not place partially hardened, contaminated, or retempered concrete.
G. Do not allow concrete to free fall over 8 feet; provide tremies, chutes, or other means of conveyance.
H. Consolidate concrete with mechanical vibrating equipment. Hand compact in corners & angles of forms.
I. Screed slabs level, to flatness tolerance of 1/4 inch in 10 feet.

3.08 FINISH OR FORMED SURFACES

A. Related Unformed Surfaces: At horizontal offset and similar unformed surfaces occurring 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.

3.09 PAVING FINISHES

A. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps. Immediately after trowel finishing, slightly roughen surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 PLACEMENT OF GROUT

A. Remove loose and foreign matter from concrete; lightly roughen bonding surface.
B. Just prior to grouting, thoroughly wet concrete surfaces; remove excess water.
C. Mix grout in accordance with manufacturer's instructions. Do not retemper.
D. Place grout continuously, by most practical means; avoid entrapped air. Do not vibrate grout.

3.11 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
C. Provide artificial heat to maintain temperature of concrete above minimum specified temperature for duration of curing period.
D. Keep forms sufficiently wet to prevent cracking of concrete or loosening of form joints.

3.12 CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively proper hardening. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 72 hours. Begin Final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 168 cumulative hours (not necessarily consecutive) during which concrete has been exposed to air temperatures above 50° F. Avoid rapid drying at end of final curing period.
B. Cure concrete in accordance with ACI 308:
   1. Horizontal surfaces:

a. Surfaces to receive additional toppings or setting beds: Use curing paper method.
b. Other surfaces: Use either curing paper or curing compound method.
2. Vertical surfaces: Use either wet curing or curing compound method.

C. Curing Compound Method:
1. Spray compound on surfaces in two coats, applying second at right angle to first, at minimum rate recommended by manufacturer.
2. Restrict traffic on surfaces during curing.
D. Curing Paper Method:
1. Spread curing paper over surfaces, lapping ends and sides minimum 4 inches; maintain in place by use of weights.
2. Remove paper after curing.
E. Wet Curing Method: Spray water over surfaces and maintain wet for 7 days.
F. Cure-Seal-Hardener: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling in strict compliance with manufacturer's written instructions and recommendations.

3.13 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, and similar parts of the work, may be removed 48 hours after placing concrete, provide concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.14 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound materials to concrete contact form surfaces as specified for new formwork.
B. When forms are extended for successive concrete placement thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill-in holes and openings left in concrete structures for passage of work by other trades, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the work.

3.16 CLEANING

A. Remove efflorescence, stains, oil, grease, and foreign materials from exposed surfaces.

3.17 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to the Architect/Engineer. Remove and replace damaged concrete as directed by Engineer.
B. Cut out honeycomb, rock pockets, voids over ½" diameter, and holes left by tie rods and bolts, down to solid concrete, but in no case to a depth of less than 1". Make edge of cuts perpendicular to the

concrete surface. Before placing cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Architect/Engineer.

3.18 FIELD QUALITY CONTROL

A. Concrete shall be sampled and tested for quality control during the placement of concrete.

B. Testing and Inspection Services:

1. Certify each delivery ticket.
2. Record time at which concrete was discharged from truck.
3. Monitor and record amount of water and water reducing admixture added to concrete at project site.
4. Determine ambient temperature and temperature of concrete sample for each set of test cylinders.
5. Test cylinders:
   a. Make test cylinders in accordance with ASTM C 172; one set of 4 cylinders for each 75 cubic yards or fraction thereof placed in any one day, for each different class of concrete.
   b. Mold and cure cylinders in accordance with ASTM C 31; test cylinders in accordance with ASTM C 39; one at 7 days and two at 28 days. Fourth cylinder collected for future testing.
6. Slump tests: Make slump tests at beginning of each day's placement and for each set of test Cylinders in accordance with ASTM C 143.
7. Air content: Determine total air content of air entrained concrete for each strength test in accordance with ASTM C 231.

C. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Test to determine adequacy of concrete will be by cored cylinders complying with ASTM C 42. Contractor shall pay for such test conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

D. Concrete shall meet the compressive strength as shown on the plans and specifications regardless of ACI 318. ACI 318 shall have no bearing on pass/fail of all site concrete.

END OF SECTION

SECTION 04 4000
STONE VENEER MASONRY

PART 1 - GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Descriptive data and installation instructions.
   2. Samples: Full size brick and stone samples showing profile and finish.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this section.
B. Obtain stone from a single quarry and from the same area within the quarry.
C. Mockup:
   1. Size: 4 feet high x 4 feet wide.
   2. Show:
      a. Stone color and texture range.
      b. Mortar joint size, color, and profile.
      c. Bond pattern.
      d. Anchors.
      e. Flashings and weeps.
   3. Locate where directed facing south.
   4. Approved mockup may not remain as part of the Work.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store stone off ground; prevent contact with materials that could cause staining or damage.
B. Protect anchors from corrosion.

1.04 PROJECT CONDITIONS

A. Wall Protection:
   1. During erection, cover tops of partially completed walls with strong waterproof membrane at end of each day or work stoppage.
   2. Extend cover minimum of 24 inches down both sides; hold securely in place.
B. Environmental Requirements:
   1. Hot weather requirements: If ambient temperature is over 95 degrees F or relative humidity is less than 50 percent, protect from direct sun and wind exposure for minimum 48 hours after installation.
   2. Cold weather requirements: Do not use frozen materials or build upon frozen work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Stone: Basis of Design - Coronado Stone Products – Texas Rubble-Summer Cottage. Manufacturing, Distribution and Sales Facility, 2025 Country Club Dr, Carrollton, TX 75006 Phone: (888) 567-2833. Website: www.coronado.com
B. Acceptable Manufacturers - Masonry Accessories:
   1. Blok-Lok Ltd. (www.blok-lok.com)
   2. Dur-O-Wal. (www.dur-o-wal.com)
   3. Heckmann Building Products. (www.heckmannbuildingprods.com)

4. Hohmann and Barnard, Inc. (www.h-b.com)
5. Laticrete, www.laticrete.com

2.02 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I.
B. Aggregate: ASTM C 144, standard masonry type.
C. Lime: ASTM C 207, Type S.
D. Water: Clean and free from oils, acids, alkalis, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.03 MIXES

A. Mortar Mixes: ASTM C 270 using the Proportion Method, Type N.
B. Mixing:
   1. Mix mortar in accordance with ASTM C 270.
   2. Jobsite Proportioning of Mortar:
      a. Mix using mechanical mixer. Hand mixing not permitted.
      b. Mix approximately three-quarters of required water, all of cement and lime, and one-half of aggregate for minimum of 2 minutes.
      c. Add remainder of water and aggregate; mix for minimum of 3 minutes.
   3. Provide uniformity of color in exposed mortar.
   4. Thoroughly mix ingredients in quantities needed for immediate use.
   5. Discard lumpy, caked, frozen, and hardened mixes.
   6. Use mortar within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-1/2 hours after initial mixing at ambient temperatures over 80 degrees F. Do not retemper mortar.
   7. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect's approval.

2.04 ACCESSORIES

A. Veneer Ties: Formed steel wire, 3/16" thickness, two piece adjustable type with backing plate, hot dip galvanized, ASTM A 153 finish. Provide polyethylene foam tape behind plates. Product/manufacturer; X-Seal™ Anchor, Hohmann & Barnard, Inc. (phone 800.645.0616 web site: www.h-b.com).
B. Fasteners: Fluoropolymer coated steel screws, minimum 3/4 inch penetration into substrate.
C. Flashings: Polyvinyl chloride sheet, 30 mils thick.
D. Sealant: Stonetech Heavy Duty Sealer by Laticrete, www.laticrete.com, or an approved equal.
E. Weeps: Preformed plastic mesh, color to be selected.

2.05 FABRICATION

A. Cut adjacent pieces from same block wherever possible.
B. Fabricate stone for uniform coloration between adjacent units and over full area of installation.
C. Fabricate for 3/8 inch beds and joints.
D. Cut or saw bed and joint surfaces square for full thickness of unit.
E. Provide holes and cutouts to accommodate items attached to stone.

PART 3 - EXECUTION

3.01 PREPARATION

A. Establish lines, levels, and coursing. Protect from disturbance.

B. Clean stone prior to installation. Do not use wire brushes or implements that can mark or damage exposed surfaces.

C. Wet absorptive stone in preparation for placement to minimize moisture suction from mortar.

3.02 INSTALLATION

A. Arrange stone pattern to provide color uniformity and varied joint sizes throughout; but not greater than 3/8" joint width.

B. Set stone plumb and level. Align adjacent pieces in same plane.

C. Set stone in full mortar setting bed; support stone over full bearing surface.

D. Equalize bed and joint openings to eliminate need for redressing exposed faces.

E. Set stone to coursed ashlar pattern.

F. Completely fill beds and joints, then rake out for pointing.

G. Tool mortar joints to concave profile.

H. Weeps:

1. Locate in head joints in first course above flashings at maximum 32 inches on center.
2. Set weeps flush with exterior face of masonry.

I. Installation Tolerances; Maximum variation from:

1. Alignment of columns and pilasters: Plus or minus 1/4 inch.
2. Alignment face to face of adjacent units: Plus or minus 1/8 inch.
3. True plane of wall: Plus or minus 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
4. Plumb: Plus or minus 1/4 inch in 10 feet noncumulative; 1/2 inch in 20 feet or more.
5. Joint thickness: Plus or minus 1/8 inch.

3.03 CLEANING

A. Protect adjacent and underlying surfaces.

B. Clean stone with detergent and water applied with fiber brush.

C. If initial cleaning does not produce acceptable results, apply cleaner in accordance with manufacturer's instructions.

1. Protect adjacent surfaces.
2. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

3.04 PROTECTION

A. Apply sealant per manufacturers written instructions.

B. Protect stone subject to damage by use of non-staining sheet coverings.

END OF SECTION

SECTION 04 4200
UNIT MASONRY

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Submittal Procedures.
   1. Product Data: Provide information on reinforcing and anchors including sizes, profiles, materials, and finishes.
   2. Samples: Brick and concrete masonry units samples in quantities showing full color and texture range.

1.02 QUALITY ASSURANCE

A. Mockup:
   1. Size: 4 feet high x 8 feet wide.
   2. Show:
      a. Masonry color and texture range.
      b. Mortar joint size, color, and profile.
      c. Each bond pattern.
      d. Anchors.
      e. Flashings and weeps.
   3. Locate mockup facing south.
B. Perform Work in accordance with TMS 402 and 602.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store masonry off ground; prevent contact with materials that could cause staining or damage.
B. Protect reinforcement and anchors from corrosion.

1.04 PROJECT CONDITIONS

A. Cold-weather construction: Implement cold weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 C, or the following procedures, when either ambient temperature falls below 40EF or temperature of masonry units is below 40°F.
   1. Preparation:
      a. Provide temperatures of masonry units not less than 20°F when laid in masonry. Do not lay masonry units containing frozen moisture, visible ice or snow on their surface.
      b. Remove visible ice and snow from top surface of existing foundations and masonry to receive new construction. Heat these surfaces to above freezing, using methods that do not result in damage.
   2. Construction: The following requirements shall apply to work in progress and shall be based on ambient temperature.
      a. Meet following construction requirements when ambient temperature is between 40°F and 32°F:
         1) Do not heat water and aggregates used in mortar and grout above 140°F.
         2) Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at time of mixing. Heat water and aggregates for grout if they are below 32°F.
      b. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 32°F and 25°F:

1) Maintain mortar temperature above freezing until used in masonry.

2) Heat aggregates and mixing water for grout to produce grout temperature between 70°F and 120°F at time of mixing. Maintain grout temperature above 70°F at time of grout placement.

c. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 25°F and 20°F:

1) Heat masonry surfaces under construction to 40°F.

2) Provide wind breaks or enclosures when the wind velocity exceeds 15 miles per hour (mph).

3) Prior to grouting, heat masonry to a minimum of 40°F.

d. Meet requirements of Building Code and the following construction requirements when ambient temperature is below 20°F: Provide enclosures and auxiliary heat to maintain air temperature within enclosure to above 32°F.

3. Protection: Requirements of this section and Building Code apply after masonry is placed and shall be based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry.

a. When temperature is between 40°F and 25°F, cover newly constructed masonry with a weather-resistive membrane for 24 hours after being completed.

b. When temperature is between 25°F and 20°F, cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. Extend time period to 48 hours for grouted masonry, unless only cement in grout is Type III Portland cement.

c. When temperature is below 20°F, maintain newly constructed masonry at a temperature above 32°F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. Extend time period to 48 hours for grouted masonry, unless the only cement in grout is Type III Portland cement.

B. Hot weather construction: Implement hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 D, or the following procedures, when temperature or temperature and wind-velocity limits of this section are exceeded.

1. Preparation: Meet the following requirements prior to conducting masonry work.

a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):

1) Provide necessary condition and equipment to produce mortar having temperature below 120°F.

2) Maintain sand piles in a damp, loose condition.

b. Special Conditions: When ambient temperature exceeds 115°F, or 105°F with a wind velocity greater than 8 mph (13 km/h), implement requirements of Building Code, and shade materials and mixing equipment from direct sunlight.

2. Construction: Meet the following requirements while masonry work is in progress.

a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):

1) Maintain temperature of mortar and grout below 120°F.

2) Flush mixers, mortar transport containers and mortar boards with cool water before they come into contact with mortar ingredients or mortar.

3) Maintain mortar consistency by retempering with cool water.

4) Mortar shall be used within 2 hours of initial mixing.

3. Special conditions: When ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement requirements of Building Code using cool mixing water for mortar and grout. The use of ice is permitted in mixing water prior to use. Do not use ice in mixing water when added to other mortar or grout materials.
4. Protection: When mean daily temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h), fog-spray newly constructed masonry until damp at least three times a day until masonry is three days old.

C. Protection of work:
1. During erection, at end of each day or shutdown period, keep walls dry by covering with waterproof material, anchored and overhanging each side of wall at least 2'-0".
2. Remove misplaced mortar or grout immediately.
3. Protect face materials against staining.
4. Protect sills, ledges and offsets from mortar droppings during construction.

D. Sequencing and scheduling: Do not enclose or cover mechanical or electrical work requiring inspection until such work has been accepted. Coordinate this work with work of other sections required to be built into masonry construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Concrete Masonry Units:
1. Featherlite Building Products. (www.featherlitetexas.com)
2. Spectra Development Corp. (www.spectraglaze.com)
3. Trenwyth Industries. (www.trenwyth.com)

B. Acceptable Manufacturers -Masonry Accessories:
1. Blok-Lok Ltd. (www.blok-lok.com)
2. Dur-O-Wal. (www.dur-o-wal.com)
3. Heckmann Building Products. (www.heckmannbuildingprods.com)
4. Hohmann and Barnard, Inc. (www.h-b.com)

C. Acceptable Manufacturers- Mortar Colorants:
1. Arizona Oxides LLC. (www.arizonaoxides.com)
2. Davis Colors. (www.daviscolors.com)
3. Solomon Colors. (www.solomoncolors.com)

2.02 MATERIALS

A. Concrete Masonry Units:
1. ASTM C 90, hollow load bearing type, normal weight
2. Size: Nominally 8 inches high x 16 inches long x thickness indicated.
3. Special shapes: Lintels, bond beams, and solid units.
4. Surface finish: Split-faced, Burnished and Standard (Ground and Polished).
5. Color: Limestone by Featherlite.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I. Provide white Portland cement for colored mortar used in laying burnished concrete masonry units. Provide natural Portland cement for all other masonry.

B. Aggregate: ASTM C 144, standard masonry type.

C. Lime: ASTM C 207, Type S.

D. Colorant: Pure mineral oxide type manufactured by Solomon Colors; color to be selected from manufacturer's full color range.

E. Water: Clean and free from oils, acids, alkalies, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.04 MIXES

A. Mortar Mixes: ASTM C 270 using the Proportion Method, Type N.

B. Mixing:

1. Mix mortar in accordance with ASTM C 270.
2. Jobsite Proportioning of Mortar:
   a. Mix using mechanical mixer. Hand mixing not permitted.
   b. Mix approximately three-quarters of required water, all of cement and lime, and one-half of aggregate for minimum of 2 minutes.
   c. Add remainder of water and aggregate; mix for minimum of 3 minutes.
3. Provide uniformity of color in exposed mortar.
4. Colorant may not exceed 9 pounds per 94 pound bag of cement for mineral oxides.
5. Thoroughly mix ingredients in quantities needed for immediate use.
6. Discard lumpy, caked, frozen, and hardened mixes.
7. Use mortar within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-112 hours after initial mixing at ambient temperatures over 80 degrees F. Do not re-temper mortar.
8. Mortar for Split-face and Burnished Concrete Masonry Units: Add water repellent admixture at manufacturer’s recommended rates to ensure mortar will be permanently water repellent.
9. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect's approval.

2.05 ACCESSORIES

A. Single Wythe Joint Reinforcement:

1. Truss type; ASTM A 951, hot-dip galvanized steel wire, 9 gage side rods with 9 gage cross ties_
2. Width: Nominal wall thickness less 1-1/2 inches.
3. Corner and tee fittings: Type to match reinforcement

B. Double Wythe Joint Reinforcement:

1. Truss type; ASTM A951,hot-dip galvanized steel wire, 9 gage side rods with 9 gage cross ties_
2. Width: Nominal wall thickness less 1-1/2 inches_
3. Corner and tee fittings: Type to match reinforcement

C. Veneer Ties: Formed steel wire, 9 gage thickness, two piece adjustable type with backing plate, hot dip galvanized, ASTM A 153 finish.

D. Fasteners: Hot-dip galvanized steel screws, minimum 3/4 inch penetration into framing.
E. Reinforcing Bars: ASTM A 615, deformed billet steel, Grade 60.
F. Flashings: Copper/kraft paper laminate, 5 ounces per square foot
G. Weeps: Flexible ultra-violet resistant polypropylene copolymer vent with cellular structure. Color shall be as selected by Architect.
H. Masonry cleaning compound: Use compound as recommended by brick manufacturer and cleaning compound manufacturer for selected brick, to ensure proposed masonry cleaning compound causes no staining nor discoloration of brick. Test cleaning compound on sample panel, as further specified.
   1. Acceptable products:
      a. Diedrich Technologies, Inc.,
         1) For dark colored brick and brick subject to non-metallic staining: 200 Lime Solv or 202 New Masonry Detergent.
         2) For light colored brick and brick subject to metallic staining: 202V Vana-Stop.
      b. ProSoCo, Inc.,
         1) For dark colored brick & brick subject to non-metallic stain: 101 Lime Solvent or Sure Klean 600.
         2) For light colored brick and brick subject to metallic staining: Vana Trol.
   2. Type: Compound of organic and inorganic acids, wetting agents and inhibitors.

PART 3 EXECUTION

3.01 PREPARATION

A. Wet brick having an absorption rate in excess of 20g per 30 square inches per minute as determined by ASTM C 67 so that absorption rate when laid does not exceed this amount.
B. Remove dirt, loose rust, and other foreign matter from reinforcement and anchors.

3.02 INSTALLATION

A. Establish lines, levels and courses indicated. Protect from displacement
B. Maintain masonry courses to uniform dimensions. Form horizontal and vertical joints of uniform thickness.
C. Lay concrete masonry in running bond. Course one masonry unit and one mortar joint to equal 8 inches.
D. Lay brick masonry in running bond unless otherwise indicated. Course three brick units and three mortar joints to equal 8 inches.
E. Lay masonry plumb and level. Do not adjust masonry units after mortar has set.
F. Lay solid masonry units in full mortar bed, with full head joints. Lay hollow masonry units with face shell bedding on head and bed joints.
G. Do not butter corners or excessively furrow joints.
H. Machine cut masonry with straight cuts and clean edges; prevent oversized or undersized joints. Discard damaged units. Do not expose cut cells.
I. Isolate masonry from structural members with compressible filler.
J. When joining fresh masonry to partially set masonry, remove loose masonry and mortar; clean and lightly wet exposed surface of set masonry.
K. Stop horizontal runs by racking back normal bond unit in each course. Teething not permitted.

L. Horizontal Reinforcement:
   1. Place reinforcement at maximum 16 inches on center vertically, at topmost course, and at first two courses above and below openings.
   2. Extend minimum 24 inches each side of openings.
   3. Center reinforcing in wall.
   4. Lap ends 6 inches minimum; use fabricated tee and corner fittings at corners and intersections.

M. Secure masonry to structural members with wall ties spaced maximum 16 inches on center.

N. Veneer Ties:
   1. Space ties to provide one tie per 2 square feet at maximum spacing of 16 inches on center horizontally.
   2. Locate ties within 3 inches of ends of masonry walls and openings.

O. Control and Expansion Joints:
   1. Do not continue horizontal joint reinforcement through joints.
   2. Keep joints free from mortar and grout
   3. Install joint backing and joint sealer at control joints in accordance with Section 07 9200.
   4. Form expansion joint as indicated on drawings.

P. Finishing Mortar Joints:
   1. Exposed locations: Tool joints to concave profile.
   2. Concealed locations: Cut joints flush.

Q. Reinforcing Bars:
   1. Position reinforcing accurately and hold securely in place to prevent displacement Maintain minimum 1 inch space between masonry and reinforcing.
   2. Grout at intervals of not more than 60 inches in 6 to 8 inch lifts.
   3. Vibrate grout during and after placement to ensure complete filling.
   4. Stop grout 1-112 inch below top of masonry if grouting is stopped for 1 hour or more, except where completing grouting of finished wall.

R. Flashings:
   1. Install flashing with outer edge flush with outside face of masonry; extend up backup 8” min. & seal.
   2. Lap end joints 4 inches minimum and seal.
   3. Form end dams where flashing is stopped or interrupted.

S. Weeps:
   1. Locate in head joints in first course above flashings at maximum 24 inches on center.
   2. Set weeps flush with exterior face of masonry.

T. Installation Tolerances; Maximum variation from:
   1. Alignment of columns and pilasters: Plus or minus 1/4 inch.
   2. Alignment face to face of adjacent units: Plus or minus 1/8 inch.
   3. Vertical alignment of head joints: Plus or minus 1/2 inch in 10 feet
   4. True plane of wall: Plus or minus 1/4 inch in 10 feet and 112 inch in 20 feet or more.
   5. Plumb: Plus or minus 114 inch in 10 feet noncumulative; 1/2 inch in 20 feet or more.
   6. Level coursing: Plus or minus 1/8 inch in 3 feet; 114 inch in 10 feet; 1/2 inch in 30 feet.
   7. Joint thickness: Plus or minus 1/8 inch.
   8. Cross sectional thickness of walls: Plus or minus 1/4 inch.

3.03 CLEANING

A. Protect adjacent and underlying surfaces.

B. Apply masonry cleaner in accordance with manufacturer's instructions.

C. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

D. Do not use water-blast cleaning on masonry.

END OF SECTION

SECTION 04 7200
CAST STONE MASONRY

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Architectural Cast Stone.

B. Units required are:

1. Exterior wall units, including wall caps, sills, surrounds, and other items as indicated.

1.02 SUBMITTALS

A. Submittals:

1. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
2. Samples: 12 x 12 inch cast stone samples showing color and finish.

B. Mortar Color Selection Samples.

C. Verification Samples: Pieces of actual cast stone components not less than 6 inches (152 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.03 RELATED REQUIREMENTS

A. Section 04 4200- Unit Masonry: Installation of cast stone in conjunction with masonry.

B. Section 07 9200 -Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.04 REFERENCE STANDARDS

A. ACI 318- Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

B. ASTM A615/A615M- Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2013.

C. ASTM A884/A884M- Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2012.

D. ASTM A1064/A1064M- Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2013.

E. ASTM C33/C33M -Standard Specification for Concrete Aggregates; 2013.

F. ASTM C150/C150M -Standard Specification for Portland Cement; 2012.

G. ASTM C270- Standard Specification for Mortar for Unit Masonry; 2012.

H. ASTM C494/C494M- Standard Specification for Chemical Admixtures for Concrete; 2013.

I. ASTM C642 -Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2013.

J. ASTM C979/C979M- Standard Specification for Pigments for Integrally Colored Concrete; 2010.

K. ASTM C1364- Standard Specification for Architectural Cast Stone; 2010b.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A firm with a minimum of 5 years' experience producing cast stone of types required for project.
2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

B. Mock-Up: Provide full size cast stone components for installation in mock-up of exterior wall.
   1. Approved mock-up will become standard for appearance and workmanship.
   2. Mock-up may not remain as part of the completed work.
   3. Remove mock-up not incorporated into the work and dispose of debris.
C. Source Quality Control: Test compressive strength and absorption of specimens selected at random from plant production.
   1. Test in accordance with ASTM C642.
   2. Select specimens at rate of 3 per 500 cubic feet (3 per 14 cubic m), with a minimum of 3 per production week.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
B. Number each piece individually to match shop drawings and schedule.
C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
D. Store cast stone components on pallets with non-staining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
F. Store mortar materials where contamination can be avoided.
G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone: All cast stone shall be provided by a single manufacturer.
   1. Heritage Cast Stone, Inc.
   2. Arriscraft.
   3. Gage Brothers Concrete Products, Inc.
   4. American Artstone.
   5. Stoneworks Architectural Precast.
   6. Substitutions: See Section 01 2500 – Substitution Procedures.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Finish: Acid etched, medium finish.
   4. Color: Selected by Architect from manufacturer's full range.
   5. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Material ID:
      a. CAST STONE-1: Trim, cap, sill, and other custom units.
   2. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
   3. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.
C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150.
   1. For Units: Type I, white or gray as required to match Architect's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.
B. Coarse Aggregate: ASTM C33, except for gradation; granite, quartz, or limestone.
C. Fine Aggregate: ASTM C33, except for gradation; natural or manufactured sands.
D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.
E. Admixtures: ASTM C494/C494M.
F. Water: Potable.
G. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized or epoxy coated.
H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
J. Mortar: Portland cement-lime, as specified in Section 04 4200.
K. Sealant: As specified in Section 07 9200.
L. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 4210.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:

1. Drench cast stone components with clear, running water immediately before installation.
2. Set units in a full bed of mortar unless otherwise indicated.
3. Fill vertical joints with mortar.
4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

D. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.

1. Rake mortar joints 3/4 inch (19 mm) for pointing.
2. Remove excess mortar from face of stone before pointing joints.
3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
   a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
   b. Joints in projecting units.
   c. Joints between rigidly anchored units, including soffits, panels, and column covers.
   d. Joints below lugged sills and stair treads.
   e. Joints below ledge and relieving angles.
   f. Joints labeled "expansion joint".

E. Sealant Joints: Install sealants as specified in Section 07 9200.

F. Installation Tolerances:

1. Variation from Plumb: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
2. Variation from Level: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches (3 mm in 900 mm) or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch (1.5 mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

G. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

1. Repair with matching touch up material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Architect 's approval.

3.03 CLEANING

A. Keep cast stone components clean as work progresses.

3.04 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Indicate profiles, sizes, spacing, and location of structural members, openings, attachments, and fasteners, and connections not detailed.

B. Quality Control Submittals: Welder Qualifications: As required by AWS D1.1.

1.02 QUALITY ASSURANCE

A. Fabricator and Erector Qualifications: Minimum 5 years documented experience in work of this section.

B. AESS (Architecturally Exposed Structural Steel) Fabricator and Erector Qualifications: In addition to those qualifications listed above, engage a firm experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance.

C. Welder Qualifications: AWS D1.1.

D. Design Requirements: Design connections not detailed on drawings under supervision of a Professional Structural Engineer experienced in this work and registered in the State of Texas.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store steel above ground on platforms, skids, or other supports; separate with wooden separators.

B. Protect steel from corrosion.

C. Prevent damage to prime coat; use wooden protectors to prevent damage from chain or cable cinches.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel:

1. Shapes: ASTM A992; , Bars and Plates: ASTM A36.
2. Hollow structural sections: ASTM A 500, Grade B.
3. Pipe: ASTM A 53, Grade B or ASTM A 501.

B. Steel Exposed-to-view: Provide Architecturally Exposed Structural Steel (AESS) framing where structural steel is exposed-to-view.

2.02 ACCESSORIES

A. Anchor Rods: F1554 Grade 36, U.N.O.

B. High Strength Bolts: ASTM A 325, Type 1, uncoated.

C. Standard Bolts: ASTM A 307, Grade A.

D. Primer Paint: SSPC Paint 15, Type 1, red oxide.

E. Non Shrink Grout: Premixed, consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; minimum 7,000 PSI compressive strength at 28 days.

F. Welding Materials: AWS D1.1, type required for materials being welded.

2.03 FABRICATION

A. Fabricate structural steel in accordance with AISC Manual.

B. Welding: Comply with AWS D1.1.

C. Where collection of water inside structural tubing could occur, provide drain hole at lowest point.

D. Cap open ends of tubes and seal weld. Wherever practical, weld connections all around. Seal seams that cannot be practically welded with joint sealer.

E. Shop Painting:

1. Shop prime steel surfaces except:
   a. Surfaces to be welded.
   b. Contact surfaces of high strength friction type bolted connections.
   c. Surfaces to receive direct-applied fireproofing.
2. Surface preparation: SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
3. Application: One coat; follow coating manufacturer's instructions.
4. Minimum dry film thickness: 1.5 mils.

F. Fabricate AESS with exposed surfaces smooth and square. Use special care in handling and shipping of AESS both before and after shop painting. In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques:

1. Fabrication Tolerance: Fabricate steel to one half the normal tolerance as specified in the Code of Standard Practice Section 10.
2. Welds Ground Smooth: Fabricator shall grind welds of AESS smooth. For groove welds, the weld Shall be made flush to the surfaces each side and be within +1/16", -0" of plate thickness.
3. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel smooth profile with adjacent material.
4. Coping and Blocking Tolerance: Maintain a uniform gap of 1/8" ± 1/32" at all copes and blocks.
5. Joint Gap Tolerance: Maintain a uniform gap of 1/8" ± 1/32".
6. Piece Marks Hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.

PART 3 EXECUTION

3.01 ERECTION OF STRUCTURAL STEEL

A. Erect structural steel in accordance with AISC Specifications.

B. Accurately assemble to lines and elevations indicated, within specified erection tolerances.

C. Align and adjust members forming parts of complete frame or structure after assembly but before fastening.

D. Provide temporary shoring and bracing members with connections of sufficient strength to resist imposed loads.

E. Align column bases with leveling bolts.

F. Align bearing plates with wedges or shims.

G. Fasten splices of compression members after abutting surfaces have been brought completely into contact.

H. Clean bearing surfaces and surfaces that will be in permanent contact before members are assembled.

I. Locate splices only where indicated.

J. Tighten erection bolts and leave in place or remove bolts and fill holes with plug welds.

K. Do not correct fabrication by gas cutting on major members.

L. Remove temporary shoring and bracing members after permanent members are in place and final connections have been made.

M. Installation Tolerances:

1. Maximum variation from plumb: 1/4 inch per story, noncumulative.
2. Maximum variation from level: 1/4 inch in 10 feet, noncumulative.
3. Maximum offset from alignment of adjacent members: 1/4 inch.
4. Displacement of centerline of exterior columns: Maximum 1 inch inward and maximum 2 inches outward.

3.02 PLACEMENT OF GROUT

A. Remove loose and foreign matter from concrete; lightly roughen bonding surface.

B. Remove foreign materials from steel surfaces; align and level members in final position.

C. Just prior to grouting, thoroughly wet concrete surfaces; remove excess water.

D. Mix grout in accordance with manufacturer's instructions. Do not retemper.

E. Place grout continuously, by most practical means; avoid entrapped air. Do not vibrate grout.

F. Do not remove leveling shims for at least 48 hours after grouting. After removing shims, fill voids with sand-cement grout.

3.03 FIELD QUALITY CONTROL

A. Testing and Inspection Services:

1. Inspect steel elements for conformance to specified requirements including:
   a. Location and adequacy of bracing.
   b. Location and set of anchor bolts and other inserts.
   c. Alignment, plumb, camber, and other required attributes.
2. Inspect high strength bolted construction in accordance with standard structural steel practices and as follows:
   a. Visually inspect high strength bolted connections.
   b. Check at least two bolts of every third connection with calibrated torque wrench for proper torque.
3. Inspect field welds in accordance with AWS D1.1 and as follows:
   a. Visually inspect welds.
   b. Test full penetration welds by ultrasonic method in accordance with ASTM E 164.
4. Special Inspections as required by Code and local jurisdictions.

3.04 ADJUSTING

A. Touch up bolt heads, nuts, field welds, and abrasions in shop coating with same primer used in shop.

END OF SECTION

SECTION 05 2100
STEEL JOIST FRAMING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Include joist identification numbers, types, locations spacings; bridging; and attachments.
   2. Joists for which standard load tables are not applicable: Bear seal of structural engineer licensed in State in which project is located.

1.02 QUALITY ASSURANCE

A. Fabricator and Erector Qualifications: Minimum 5 years documented experience in work of this section.
B. Welder Qualifications: AWS D1.1.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store joists off ground; prevent contact with adjacent joists.
B. Prevent damage to painted surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Canam Steel. (www.canamsteel.com)
   2. SMI Joist Co. (www.smijoist.com)
   3. Socar, Inc. (www.socarinc.com)
   4. Vulcraft Div., Nucor Corp. (www.vulcraft.com)

2.02 MATERIALS

A. Steel Shapes: Per SJI.

2.03 ACCESSORIES

A. Bolts, Nuts, and Washers: ASTM A325.
B. Primer Paint: SSPC Paint 15, Type 1, red oxide.
C. Welding Materials: AWS D1.1; type required for materials being welded.

2.04 FABRICATION

A. Fabricate joists to SJI Series LH requirements.
B. Provide end extensions where indicated.
C. Frame special sized openings in joist chord framing as indicated.
D. Provide bracing, bridging, anchors, connectors, and other accessories.

E. Shop Painting:
   1. Shop prime steel surfaces except:
      a. Surfaces to be welded.
      b. Surfaces to receive direct-applied fireproofing.
   2. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
   3. Application: One coat; follow coating manufacturer's instructions.
   4. Minimum dry film thickness: 1.5 mils.

PART 3 EXECUTION

3.01 ERECTION

A. Erect joists and accessories in accordance with SJI Specifications.
B. Provide for distribution of concentrated loads incurred during erection.
C. Complete bridging and permanently fasten joists in place before applying loads except as necessary for erection.
D. Welding to conform to AWS D1.1.
E. Erect joists to elevations, lines, and spacings indicated.
F. Coordinate placement of anchors in other construction for securing bearing plates and wall attachments.
G. Frame openings greater than 18 inches with supplementary framing.
H. Position and field weld joist chord extensions and wall attachments.

3.02 FIELD QUALITY CONTROL

A. Testing and Inspection Services:
   1. Inspect joists for conformance to specified requirements:
      a. Verify placement including location, alignment, and bearing.
      b. Inspect joist-to-seat and seat-to-support welds in accordance with AWS D1.1.

3.03 ADJUSTING

A. Touch Up: Clean welds and abrasions after erection; touch up with same primer as originally applied.

END OF SECTION

SECTION 05 3100
STEEL DECKING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Indicate decking plan, support locations, projections through decking, openings, pertinent details, and accessories.
   2. Product Data: Provide deck profile, characteristics, dimensions, structural properties, and finish.

1.02 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Minimum 5 years documented experience in work of this section.

B. Design Requirements: Design decking including layout, spans, fasteners, and joints under supervision of a Professional Structural Engineer experienced in this work and registered in the State in which the project is located.

C. Welder Qualifications: AWS D1.3.

D. Perform work in accordance with SDI Manual.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store decking off ground at site, with one end elevated to provide drainage; protect with waterproof covering, properly vented.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Cordeck. (www.cordeck.com)
   2. Epic Metals Corp. (www.epicmetals.com)
   3. Vulcraft Div., Nucor Corp. (www.vulcraft.com)

2.02 MATERIALS

A. Galvanized Steel Sheet: ASTM A653, Structural Quality, G90 coating class.

2.03 ACCESSORIES

A. Touch Up Paint: SSPC Paint 20, Type I or II.

B. Fasteners: Hot-dip galvanized steel, self-tapping.

C. Welding Materials: AWS D1.3; type required for materials being welded.

2.04 FABRICATION

A. Fabricate deck and accessories to SDI Design Manual.

B. Roof Deck Type: SDI intermediate rib configuration.

1. Minimum Material Thickness: 22 gage, excluding finish.
2. Formed Sheet Width: 36 inches.
3. Minimum Depth: 1-1/2 inches.
4. Side Joints: Lapped.
5. Form units to span three or more supports, with lapped ends and nesting side laps.
6. Accessory Strips: Fabricate metal closure strips and cover plates of 22 gage sheet steel.
7. Roof Sump Pans: Fabricate of 14 gage galvanized sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, 3 inch wide bearing flange, with joints sealed watertight.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install decking and accessories in accordance with manufacturer's instructions and SDI Design Manual.

B. Roof Deck:

1. Lap ends 2 to 4 inches. Center laps over supports.
2. Do not stretch or contract side lap interlocks.
3. Place deck units flat and square, without warp or deflection.
4. Provide minimum 1-1/2 inch bearing on steel supports, minimum 4 inch bearing on other materials.
5. Weld decking to supporting members. Welding to conform to AWS D1.3.
6. Mechanically fasten side laps between adjacent deck units at maximum 18 inches on center.
7. Cut and fit deck and accessories at perimeter and around projections and openings. Make cuts neat and trim.
8. Position roof sump pans with flange bearing on top surface of deck. Fasten at each deck flute.
9. Provide strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings. Weld strips into position.
10. Provide minimum 6 inch wide cover strips where deck changes direction. Weld or mechanically fasten strips into position.
11. Install closures and angle flashings to close openings between deck and walls, columns, and openings.

3.02 FIELD QUALITY CONTROL

A. Testing and Inspection Services:

1. Inspect decking for conformance to requirements of Contract Documents, including:
   a. Deck type and gage.
   b. Deck placement and alignment.
   c. Welds and weld pattern.
   d. Fastener types, locations, quantities, and placement.

3.03 ADJUSTING

A. Touch Up:

1. Wire brush and clean scarred areas, welds, and rust spots on decking units and supporting steel members.
2. Touch up galvanized coatings with galvanizing repair paint; apply as recommended by manufacturer.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SYSTEM DESCRIPTION

A. Minimum design loads:
   1. Pedestrian loading:
      a. Uniform load of 100 PSF.
      b. Concentrated load of 300 pounds.
      c. Maximum deflection under loading: L/240.
   2. Guard rails and handrails:
      a. 50 pounds per linear foot applied in any direction at top, transferred via attachments and supports to building structure.
      b. Concentrated 200 pound load applied in any direction at any point along top, transferred via attachments and supports to building structure.
      c. Maximum deflection under loading: L/120.
   3. Concentrated and uniform loads do not need to be applied simultaneously.
B. Fabricate guard rails and handrails in accordance with ASTM E 985.

1.03 SUMMARY

A. Section Includes:
   1. Steel framing and supports for countertops.
   2. Steel tube reinforcement for low partitions.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Shelf angles.
   6. Metal ladders
   7. Ladder safety cages.
   8. Loose bearing and leveling plates for applications where they are not specified in other Sections.
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.
C. Related Requirements:
   1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Section 04 4220 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into concrete unit masonry.

3. Section 05 1200 "Structural Steel Framing”
4. Section 12 9300 "Site Furnishings" for bicycle racks.

1.04 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.05 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Show dimensions, metal thicknesses, finishes, joints, attachments, and relationship of work to adjacent construction. Show fabrication and installation details. Provide Shop Drawings for the following:
   1. Steel framing and supports for coiling doors.
   2. Steel framing and supports for countertops.
   3. Steel tube reinforcement for low partitions.
   4. Steel framing and supports for mechanical and electrical equipment.
   5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   6. Shelf angles.
   7. Metal ladders.
   8. Ladder safety cages.
   9. Metal downspout boots.
   10. Loose steel lintels.

B. Delegated-Design Submittal: For ladders and tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design ladders and tread devices.

B. Structural Performance of Tread Devices: Tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   1. Uniform Load: 100 lbf/sq. ft.
   2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

C. 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.

2.02 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

F. 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.

G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

H. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches or As indicated.
   2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

L. Nosings for Concrete Steps: Cast iron, cross hatched abrasive surface, 9/16 inch nosing, 4 inches deep x step width less 6 inches. Provide Type 101 abrasive cast safety nosing as manufactured by Wooster Products, Inc.; www.wooster-products.com.

2.03 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.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

F. 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.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical 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.

H. 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.

2.04 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 9100 " Painting,"

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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. Form exposed work with accurate angles and surfaces and straight edges.

E. 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 so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 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.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with where indicated.

2.07 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.08 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3, except for elevator pit ladders.

B. Steel Ladders:
   1. Provide McNichols ‘Grip Strut’ panels and treads or an approved equal.
   2. Space siderails 16 inches apart unless otherwise indicated.
   3. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
   4. Rungs: 3/4-inch- diameter steel bars.
   5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 3/4 inch in least dimension.
   8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
   9. Galvanize exterior ladders, including brackets.

2.09 LADDER SAFETY CAGES

A. General:
   1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
   2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
   3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages:
   1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
   2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
   3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.

4. Galvanize and prime ladder safety cages, including brackets and fasteners.

2.10 TREAD DEVICES

A. Tread Devices: Provide McNichols 'Grip Strut' panels and treads or an approved equal. Fabricate tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
   1. Tread depth shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 9-1/2 inches.
   2. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
   3. Comply with applicable railing requirements in Section 05 5213 "Pipe and Tube Railings."

B. Galvanize exterior steel tread devices, including treads, railings, brackets, and fasteners.

C. 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.

2.11 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.

B. Galvanize plates.

2.12 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. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.13 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.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 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.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. 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 indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. 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.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 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. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing & supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Structural Steel Door Frame for Jamb Mounted Sectional and Rolling Doors: Frames of carbon steel shapes, bars and plates, fully welded, uniform, square, and true, as detailed for the rolling doors.
   1. Miter and weld corner joints and grind exposed welds smooth.
   2. Continuously weld exposed joints; grind exposed welds smooth.
   3. Provide necessary reinforcements and drill & tap as required for finish hardware.
   4. Galvanize exterior structural steel door frames and anchors.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.04 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 non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated & abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wood framing, blocking, cants, and nailers.
   2. Wood furring.
   3. Plywood.
   4. Preservative treatment.
   5. Fire retardant treatment.
   6. Fasteners.
   7. Related accessories.

1.02 SUBMITTALS

A. Submit items in accordance with Section 01 3300.

B. Product Data: Provide technical data on wood preservative and fire retardant treatment materials and application techniques/instructions.

C. Manufacturers Certificates: Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
   1. Southern Pine Inspection Bureau (SPIB).
   2. West Coast Lumber Inspection Bureau (WCLIBB).
   3. Western Wood Products Association (WWPA).

B. Grade Marks: Identify lumber and plywood by official grade mark.
   1. Lumber: Include symbol of grading agency, mill name, grade, species, grading rules and condition of seasoning at time of manufacturer.
   2. Plywood: Include type, class identification index, and agency mark.

C. Requirements of Regulatory Agencies
   1. Preservative and Pressure Treated Lumber and Plywood: Comply with American Wood Preservers Bureau Standards.
   2. Fire Retardant Treated Materials: Comply with Underwriters Laboratories, Inc. and ASTM E84, for maximum flame spread of 25.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle, and protect products in accordance with Section 01 6000 Product Requirements.

B. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.

C. Do not store seasoned materials in damp or wet locations.

D. Support products in such a way as to prevent warping and distortion.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Where stress rating values are given in lieu of grades, select any quality which will meet structural requirements.

B. Lumber
   1. Grading rules: PS 20.
   2. Dimensions: Lumber dimensions are nominal except for posts and timbers; actual dimensions conform to industry standards established by the American Lumber Standards Committee and applicable rules writing agencies. Provide sizes as detailed.
   3. Moisture Content: 19 percent maximum moisture content after treatments for fire retardant and preservative treated woods.
   4. Surfacing: Surface four sides (S4S), unless noted otherwise.
   5. Species: Southern Yellow Pine or West Coast Douglas Fir, unless noted otherwise.
   6. Uses, Grades, and Stress Ratings
      a. Non-structural light framing (2 to 4 inch thick, 2 to 4 inch wide):
         1) General Framing: Standard and better or Stud grade.
         2) Plates, Blocking, Bracing, Nailers: Utility grade.

C. Plywood
   1. Grading rules: PS 1, using group 1 to 4 species as required for rating.
   2. Exposures: Provide exposure ratings as indicated.
   3. Thickness: 3/4" Typical, or as detailed or noted, or otherwise as required to maintain span capability.
   4. Uses, Grades, Ratings
      a. Wall, Roof, and Parapet Sheathing: C-D/Exposure 1-APA, Rated Sheathing 16/0 span rating.
      b. AC with A side exposed at all locations for exposed plywood as a finish.
      c. Telephone Backer Board: A-D/Exposure 2 – APA Rated Sheathing.

D. Wall Panels:
   1. Plywood Panels: 19/32" T1-11 Plywood with deep grooves, Painted, Interior/Exterior applications
   2. Face Species: Rough Sawn, Vertical Grain Douglas Fir.
   3. Veneer Cut – Rough Sawn; 48 inches wide x 19/32 inch thick, maximum practical length, square cut ends and edges.
   4. Core:
      a. Description: Western softwood veneer; manufactured using ULEF resin.
      b. Comply with ANSI/HPVA HP-1.
      c. Comply with EPA TSCA Title VI, Ultra Low Emitting Formaldehyde (ULEF) exempt.

E. Plastic Cement: ASTM D 2822, asphalt base.

F. Fasteners
   1. Provide fasteners in sizes, spacings, and locations to suit applications. Hot dip galvanize unless noted otherwise.
   2. Bolts: FS FF-B-575, FF-B-584 or ASTM A 307.
   3. Nuts: FS FF-N-836.
   4. Expansion shields, lag screws, and bolts: FS FF-B-561.

5. Toggle bolts: FS FF-B-588.
6. Wood screws: FS FF-S-111.
7. Nails and staples: FS FF-N-105.
8. Metal nailing discs
   a. Flat caps, minimum 1 inch diameter.
   b. Minimum 30 gage sheet metal.
   c. Formed to prevent dishing.
   d. Bell or cup shapes not acceptable.

2.02 WOOD TREATMENTS - SHOP PREPARED

A. Preservative Treated Wood
   1. Preservative treat fascia blocking, roof edging, sill plates and grounds in contact with concrete, except on interior of building; roof curbs, cants and nailers for flashing, and elsewhere as noted or shown.
   2. Use waterborne salt preservatives as follows: AWPB LP-2 above ground; AWPB LP 22 ground contact. Redry lumber to maximum 19 percent moisture content, stamp with AWPB "Dry". Redry plywood and particleboard to 15 percent maximum moisture content.
   3. Field treat surface cuts & holes in accordance with AWPA M4.

B. Fire Retardant Treated Wood
   1. Use fire retardant treated wood for all wood blocking above ceilings, blocking within return air plenums, blocking within walls, and other areas required by reference building codes.
   2. Comply with AWPA C20 for lumber and AWPA C27 for sheet materials.
   3. Provide finished products with maximum flame spread rating of 25, when tested in accordance with ASTM E 84.
   4. Acceptable Treatment Companies/Methods
      a. Dricon by Arxada, (www.wolmanizedwood.com)
      b. FlamePro by Koppers, (www.koppersperformancechemicals.com)
      c. Prowood FR by UFP Industries, Inc., (www.prowoodlumber.com)
   5. Where treated items are exposed to exterior or to high humidity or are to have a transparent finish applied, provide materials which show no change in fire hazard classification when subjected to standard rain test (UL 790).
   6. Use fire retardant treatment which will not bleed through or adversely affect type of finish indicated & which does not require brush treatment of field-made end cuts to maintain fire hazard classification.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.02 INSTALLATION

A. General:
   1. Discard units of material with defects which might impair quality of work, and units which are too

small to fabricate work with minimum joints or optimum joint arrangement.

2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.
3. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards and as required to draw members into place and securely hold same unless otherwise indicated. Use washers under all bolt heads.
4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
5. Make tight connections between members to develop full strength of members.
6. Install fasteners without splitting of wood.
7. Predrill as necessary.
8. Comply with APA E30a requirements for plywood.
9. Install fasteners at spacings recommended by NFPA National Design Specifications for Stress Grade Lumber and Its Fastening - 1973 for lumber and APA Guide E30e for Plywood, unless more restrictive code requirements dictate tighter spacing or heavier fasteners.
10. Locate members as indicated on the drawings. Do not change size, spacing or spans without specific approval of Architect. Take care to place proper grades and species of members where indicated in accordance with the lumber schedule herein.
11. Temporarily brace framing at the end of each day's work until framing is completed and securely anchored. Leave temporary bracing in place as long as required for safety. As work progresses, securely connect work to compensate for dead load, wind and erection stresses.

B. Wood Grounds, Nailers, Cants, and Blocking

1. Provide where required for screeding or attachment of other work.
2. Form to shapes cut as necessary for true line and level of work to be attached.
3. Coordinate location with other work involved.
4. Attach to substrates to support applied loading.
5. Countersink bolts and nuts flush with surfaces & where built into masonry work.
6. Where possible, anchor to formwork before concrete placement.
7. Provide permanent grounds of dressed, preservative treated, key beveled lumber not less than 1/2 inch wide, and of thickness required to bring face of ground to exact thickness of finish material involved.
8. Provide continuous blocking.
9. Remove temporary grounds when no longer required.
10. Curb all roof openings except where prefabricated curbs are provided.
11. Provide solid preservative cants where roof surfaces meet walls, curbs or other vertical projections.

C. Plywood Sheathing

1. Install with long edge perpendicular to framing, with edges aligned for 1/8 inch width joints.
2. Place ends over framing members.
3. Secure with galvanized power driven screws to each support spacing fasteners at 12 inch on center for intermediate supports and 6 inch on center for ends supports.

3.03 TOLERANCES

A. Framing members: 1/4 inch maximum from true position.

B. Surface flatness of floors/roofs: 1/4 inch in 10 feet maximum.

3.04 PROTECTION

A. Protect products from moisture absorption and subsequent warping or deterioration until subsequent construction can proceed.

END OF SECTION

SECTION 06 1600
GYPSUM SHEATHING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 – Submittal Procedures.

1. Product Data: Illustrate panel product types, thicknesses, and installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:

1. GP Gypsum Corporation. (www.gp.com)
2. National Gypsum Co. (www.nationalgypsum.com)
3. Temple-Inland. (www.templeinland.com)

2.02 MATERIALS

A. Exterior Sheathing:

1. Source: DensGlass Sheathing by Georgia-Pacific (phone 800.225.6119 website www.gpgypsum.com) or approved substitute.
2. Type: ASTM C1177 or ASTM C1278; 48 inches wide x 5/8 inch thick, maximum practical length, square cut ends and edges.
3. Mold resistance: 10, tested to ASTM D3273.

2.03 ACCESSORIES

A. Fasteners: ASTM C1002, Type S screws, fluoropolymer coated steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with ASTM C1280 and manufacturer's instructions.

B. Accurately cut panels to fit around openings and projections.

C. Apply panels vertically, with ends and edges occurring over supports.

D. Fasten panels to framing at maximum 8 inches on center. Place fasteners minimum 3/8 inch from edges of panels; drive heads flush with surface. Stagger fasteners at abutting edges.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets.
   2. Architectural wood cabinets.
   3. Display Case wood cabinets
   4. Shop finishing of architectural wood cabinets.
   5. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
   1. Section 06 1000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: For each type of product high-pressure decorative laminate and cabinet hardware and accessories.
   2. Shop Drawings:
      a. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
      b. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
      c. Show locations and sizes of cutouts and holes for electrical switches and outlets installed in architectural plastic-laminate cabinets.
      d. Designate wood species and finishes.
   3. Samples: 3 x 3 inch plastic laminate samples for each type, color, pattern, and surface finish and specified edge material applied to one edge.
   4. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces.
      b. Miter joints for standing trim.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications:
   1. Minimum 5 years documented experience in work of this section.
   2. Certified under AWI Quality Certification Program.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials until proper protection can be provided, and until needed for installation.

B. Do not deliver cabinets until painting and similar operations that could damage woodwork have

been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in Field Conditions.

1.05 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.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.06 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Plastic Laminate:

1. Formica Corp. (www.formica.com)
2. Nevamar Co. (www.nevamar.com)
3. Wilsonart International, Inc. (www.wilsonart.com)
4. Pionite Co. (www.pionite.com)

B. Acceptable Manufacturers - Solid Surfacing:

1. Cosentino. (www.cosentino.com)
2. Caesarstone. (www.caesarstoneus.com)
3. Avonite, Inc. (www.avonitesurfaces.com)
4. DuPont. (www.corian.com)
5. Wilsonart International, Inc. (www.wilsonart.com)

2.02 CABINET MATERIALS

A. Panel Products:

1. Graded in accordance with AWI Section 200 requirements for quality grade specified.
2. Panel core: Medium density fiberboard.

B. Hardboard: Pressed wood fiber with resin binder; tempered grade, 1/4 inch thick, smooth both sides.

C. Plastic Laminate: NEMA LD-3.

1. Horizontal Surfaces:
   a. Backing Sheet: Grade BGF.
   b. Postformed Surfaces: Grade HGP.
   c. Other Surfaces: Grade HGS.
2. Vertical surfaces:
   a. Backing Sheet: Grade BLF.
   b. Cabinet Liner: Grade CLS.
   c. Other Surfaces: Grade VGP.
3. Colors: Wilsonart Laminate – **Burnished Chestnut-4796-60, Matte Finish & Warehouse Oak-7969K-12, Softgrain Finish.**
4. Cabinet Interior: White Melamine.

D. Lumber:
1. Graded in accordance with AWI Section 100 requirements for quality grade specified, average moisture content of 6 percent.
2. Exposed and semi-exposed locations: White Oak species, rift cut, quality to suit transparent finish.
3. Wood Ceilings, Beams and Soffits: 1 x 6 ship lap Lyptus of quality suitable for transparent finish.

E. Fifty percent of all new wood products used on the project shall be Forest Stewardship Council (FSC) Certified.

2.03 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:
1. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521.
C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
D. Catches: Magnetic catches, BHMA A156.9, B03141.
E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
F. Drawer Slides: BHMA A156.9.
1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1HD-100.
3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD- 200.
5. For computer keyboard shelves, provide Grade 1HD-100.
6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.

G. Door Locks: BHMA A156.11, E07121.
H. Drawer Locks: BHMA A156.11, E07041.
I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
K. Finish Hardware: As scheduled at end of section.

2.04 DISPLAY CASE MATERIALS

A. Recessed Display Case: Shop-fabricated display case; with finished interior, operable glazed doors at front, and trim on face to cover edge of recessed opening.
   1. Display Case Sizes: As indicated on Drawings.

B. Display Case Cabinet Lumber:
   1. Graded in accordance with AWI Section 100 requirements for quality grade specified, average moisture content of 6 percent.
   2. Exposed and semi-exposed locations: White Oak species, rift cut, of quality suitable for transparent finish.

C. Face Frame: Constructed and finished same as cabinet.

D. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.
   1. Number of Shelves: As indicated on Drawings.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface. Provide standards extending full height of display case.

F. Lighting: Recessed LED Tape lighting mounted inside of the box. Voltage: 24 volts. (Ref. Electrical)

G. Display case Sizes: As shown on drawings.

H. Finish Hardware: As scheduled at end of section.

2.05 MISCELLANEOUS ACCESSORIES

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.06 ACCESSORIES

A. Quartz Surfacing; Basis-of-design: **Silestone Quartz as manufacture by Cosentino.**
   1. Composition: Quartz aggregate, polyester resin, and color pigments formed into flat slabs.
   2. Anti-microbial Protection: Microban by Microban International, Inc., integral to sheet.
   3. Thickness: As indicated on drawings.
   4. Color: To be selected from manufacturer's full color range.
   5. Surface Finish: Polished.

B. Fasteners: Type and size as required by conditions of use.

C. Adhesives: Waterproof, solvent release type, compatible with backing and laminate materials.
   1. General: Do not use adhesives that contain urea formaldehyde.

2.07 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. 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.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

C. 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.

D. Cabinets - Plastic Laminate Finish:
   1. Quality: AWI Section 400, Premium Grade.
   2. Type: Flush overlay.
   3. Semi-exposed surfaces: Plastic laminate.
   4. Fit exposed and semi-exposed panel edges with matching laminate edging.
   5. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.

E. Cabinets - Transparent Finish:
   1. Quality: AWI Section 400, Premium Grade.
   2. Type: Flush overlay.
   3. Semi-exposed surfaces: Wood to match exposed surfaces.
   4. Fit exposed and semi-exposed panel edges with matching wood edging.
   5. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.

F. Plastic Laminate Countertops:
   1. Quality: AWI Section 400, Premium Grade.
   2. Fabricate from panel product with lumber fronts.
   3. Locate end joints centered or symmetrical. Join sections with concealed clamp fasteners. Locate plastic laminate butt joints minimum 2 feet away from sinks.
   4. Provide holes and cutouts for mounting of sinks and accessories.

G. Solid Surfacing Countertops:
   1. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
      a. Finish – **Wilsonart – Sea Stone 9202CS (miter at edges with turn down)**
      b. Grade: Custom.
   2. Configuration:
      a. Front: Straight, slightly eased at top.
      b. Backsplash: Straight, slightly eased at corner.
      c. End Splash: Matching backsplash.
   3. Countertops: 1/2-inch- thick, solid surface material.
   4. Backsplashes: 1/2-inch- thick, solid surface material.
   5. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
      a. Fabricate with loose backsplashes for field assembly.
   6. Joints: Fabricate countertops without joints.
   7. Cutouts and Holes:
      a. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

b. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

H. Shop assemble for delivery to project site in units easily handled.

I. Prior to fabrication, field verify dimensions to ensure correct fit.

J. Apply plastic laminate in full uninterrupted sheets; fit corners and joints to hairline. Slightly bevel arises. Apply laminate backing sheet to reverse side of laminate faced surfaces.

K. Where field fitting is required, provide ample allowance for cutting. Provide trim for scribing and site conditions.

L. Provide cutouts and reinforcement for plumbing, electrical, appliances, and accessories. Prime paint surfaces of cut edges.

2.08 FINISHES

A. Transparent Finish System:

1. Finish system: AWI Section 1500, Premium Grade, Conversion Varnish.
2. Stain color: To be selected from manufacturer's full color range.
3. Sheen: Satin.

PART 3 EXECUTION

3.01 PREPARATION

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

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.02 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. 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 .

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. 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.

1. Use filler matching finish of items being installed.

F. 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 screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, 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.

C. Clean cabinets on exposed and semi-exposed surfaces.

3.04 FINISH HARDWARE SCHEDULE

DESCRIPTION	MANUFACTURER	MODEL
Door and drawer pull	Stanley	4484
Drawer slides	K&V	8400 & 8900
Drawer slides, file drawers	K&V	8500
Door hinge	Blum	CLIP Top 170°
Cabinet lock	National Lock	C8055-14A
Adjustable shelf standards and brackets	K&V	255 + 256

END OF SECTION

SECTION 07 1110
DAMPPROOFING

PART 1 – GENERAL

1.01 SUBMITTALS

A. General: Submit following items under provisions of Section 01 6000 - Product Requirements.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.02 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Waterproofing Manual, and manufacturer's instructions, whichever are more stringent.

B. For interior and concealed in all applications, provide product certified by manufacturer to be substantially odor-free within 24 hours of application.

1.03 QUALIFICATIONS

A. Applicator Qualifications: Company experienced in application of dampproofing with 3-years' experience on similar sized projects.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect in accordance with manufacturer's recommendations for handling.

B. Do not allow products to become frozen.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperature above 40°F. for 24 hours before application and continuously until mastic dampproofing has cured.

B. Do not allow dampproofed surfaces to be exposed to prolonged sunlight.

C. Do not allow membrane dampproofing to remain exposed to the elements for longer than 30 days.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mastic: ASTM D 1227, Type II, Class 1, semi-mastic asphaltic emulsion reinforced with non-asbestos fibers. Product/manufacturer; one of the following:

1. Sealmastic; W.R. Meadows, Inc.
2. Henry 787 Elastomeric Fluid-applied Waterproofing Membrane
3. Hydrocide 700B; Sonneborn, a Div. Of BASF Construction Chemicals

2.02 ACCESSORIES

A. Mastic Dampproofing:
   1. Emulsion Based Dampproofing: Non-asbestos fiber reinforced emulsion asphaltic compound, brush or spray consistency, meeting requirements of ASTM D 1227 or FS-4-1781.
   2. Reinforcing Mesh; Treated glass fabric, woven design, 20 x 10 mesh.
   3. Plastic Cement: Type recommended by manufacturer and compatible with dampproofing product, for trowel consistency.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
B. Do not apply when surface of ambient temperature is below 40°F., during inclement weather, or if surface is damp, dirty, or dusty.
C. Verify surfaces are solid and free of cracks, pits, rough or sharp projections.
D. Verify items which penetrate surface to receive dampproofing are securely anchored.
E. Verify that reglets have been set and are ready to receive the work of this section.

3.02 PREPARATION

A. Remove rough or sharp projections, loose particles, and foreign matter detrimental to adhesion and application of dampproofing.
B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturers written instructions.
C. Apply two coats of plastic cement and one layer of reinforcing mesh (between plastic cement coats) to seal penetrations, small cracks, and at other areas as recommended by manufacturer.
D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at control joints.

3.03 INSTALLATION

A. Mastic Dampproofing: For application over concealed masonry and concrete surfaces.
   1. Clean surfaces of excess mortar and loose dirt and apply the mastic in two coats by brush or spray. Allow the first coat to dry tacky before applying the second coat.
   2. Coverage shall be approximately 35 sq.ft. per gallon per coat. Fill in crevices and grooves and around projecting anchors and joint reinforcement. Make sure that coating is continuous and free from breaks and pinholes.

3.04 FIELD QUALITY CONTROL

A. Tests: Periodically (not less than once per 100 sq.ft. of surface area) check application thickness to verify compliance with specified thickness. Immediately re-apply if found to be deficient.

3.05 PROTECTION

A. Protect finished installation.

B. Protect adjacent surfaces not to receive dampproofing against "overspray" or "over brush".

C. Protect dampproofing against damage during backfilling with adhered protection course, neatly fitted around projections and penetrations. Do not apply until dampproofing has thoroughly cured.

D. Protect flashing until placement within wall is complete. Do not allow wind to displace or damage flashing.

END OF SECTION

SECTION 07 1313
BITUMINOUS SHEET WATERPROOFING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals for Review: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Include termination details and interface with adjacent construction.
   2. Product Data: Manufacturer's data for waterproofing and protection board including product description and performance characteristics.
   3. Warranty: Sample warranty form.

1.02 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Minimum 5 years documented experience in work of this section.
   2. Licensed or certified by waterproofing manufacturer.

B. Pre-Installation Conference:
   1. Convene at site 2 weeks prior to beginning work of this section.
   2. Attendance: Architect, Construction Manager, waterproofing applicator, waterproofing manufacturers representative, and related trades.
   3. Review and discuss Contract Documents, waterproofing system manufacturer's literature, job conditions, scheduling, and other matters affecting application as appropriate.
   4. Tour representative areas of waterproofing substrates, and discuss substrate construction, related items, work conditions, and materials compatibility.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store materials in enclosed space; protect from weather and direct sun. Maintain temperature range in storage area between 40 to 90 degrees F.

1.04 PROJECT CONDITIONS

A. Environmental Requirements: Do not apply during inclement weather.

B. Substrate: Cured minimum 7 days.

1.05 WARRANTIES

A. Furnish manufacturer’s 5-year warranty providing coverage against water leakage through waterproofing system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Carlisle Coatings and Waterproofing. (www.carlisle-ccw.com)
   2. Grace Construction Products. (www.graceconstruction.com)
   3. W.R. Meadows, Inc. (www.wrmeadows.com)
   4. Polyguard Products, Inc. (www.polyguardproducts.com)

2.02 MATERIALS

A. Bituminous Sheet Membrane Waterproofing System:

1. Preformed rubberized asphalt laminated to polyethylene film with release paper facing, self-adhering, minimum 60 mils thick, 36 inch wide rolls.
2. Physical properties:

PROPERTY	TEST METHOD	RESULTS
Tensile Strength, Film	ASTM D882	Minimum 5,000 psi
Tensile Strength, Membrane	ASTM D412	Minimum 250 psi
Elongation, Membrane	ASTM D412	Minimum 300 percent
Moisture Vapor Permeance	ASTM E96, Method B	Maximum 0.1 perms
Puncture Resistance, Membrane	ASTM E154	Minimum 40 pounds
Water Absorption, Membrane	ASTM D570	Maximum 0.2 percent by weight

2.03 ACCESSORIES

A. Primers, Mastics, and Liquid Membranes: As recommended by waterproofing system manufacturer.

B. Patching Compound: Premixed, latex modified Portland cement grout.

C. Joint Sealers: Specified in Section 07 9200.

D. Protection Board: Extruded polystyrene with plastic facing both sides, 1/4 inch thick.

PART 3 - EXECUTION

3.01 PREPARATION

A. Substrate Preparation:

1. Remove protrusions flush with adjacent surface.
2. Remove loose and spalled concrete.
3. Patch holes and depressions with patching compound; finish flush.

B. Clean surfaces; remove loose and foreign matter that could impede adhesion or performance of waterproofing.

C. Dynamic Cracks and Joints:

1. Remove loose and spalled concrete.
2. Patch holes and depressions with patching compound.
3. Rout out crack or joint to minimum dimensions of 1/4 inch deep x 1/2 inch wide.

3.02 INSTALLATION OF WATERPROOFING

A. Install waterproofing system in accordance with manufacturer's written instructions and recommendations.

B. Apply primer to coverage rate required by manufacturer.

1. Allow to dry until tack free.
2. Cover only that area that will be covered with membrane in same day.
3. Re-apply if left uncovered over 24 hours.

C. Form 3/4 inch fillet with liquid membrane on inside corners; extend minimum 6 inches on both sides of corner at minimum 90 mils thick.

D. Cover static cracks and joints in substrate with minimum 9 inch wide membrane strip.

E. Cover dynamic cracks and joints with minimum 9 inch wide membrane strip applied in reverse, with release paper left in place to form bond breaker. Cover that with an 18 inch wide strip placed in normal manner.
F. Cover inside and outside corners with minimum 12 inch wide membrane centered over corner.
G. Apply membrane with minimum 2-1/2 inch side and end laps; roll surface to eliminate wrinkles and air spaces.
H. Terminate top edge of membrane at grade with metal reglet.
I. Terminate bottom edge of membrane within 1 inch of bottom of wall; seal edge with trowel bead of mastic.
J. Apply membrane on horizontal surfaces starting at low point, laying membrane perpendicular to slope. Weatherlap joints.
K. Provide double membrane layer minimum 6 inches around penetrations; seal with mastic.
L. If application is not complete at end of work day, seal exposed edges with mastic.

3.03 INSTALLATION OF PROTECTION BOARD

A. Apply protection board the same day membrane is applied.
B. Install in accordance with manufacturer's instructions.
C. Apply adhesive at rates as recommended by manufacturer; set boards in adhesive with edges butted.
D. Complete backfilling as soon as possible after application of protection board; within 7 days maximum.

3.04 FIELD QUALITY CONTROL

A. Prior to applying protection course, inspect surfaces for voids, ruptures, and other damage.
B. Repair damaged and defective areas.

END OF SECTION

SECTION 07 1326
SELF-ADHERING SHEET WATERPROOFING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals for Review: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
   3. Warranty: Sample warranty form.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.03 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or

surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Hydrotech, Inc.
   b. Carlisle Coatings & Waterproofing Inc.
   c. CETCO, a Minerals Technologies company.
   d. Grace Construction Products; W.R. Grace & Co. -- Conn.
   e. Polyguard Products, Inc.
   f. W. R. Meadows, Inc.
2. Physical Properties:
   a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
   e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
   h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

G. Protection Course: ASTM D 6506, semi-rigid sheets of fiberglass or mineral-reinforced asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
   1. Thickness: 1/8 inch, nominal, for vertical applications; 1/4 inch, nominal, elsewhere.
   2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

2.04 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel: Comply with Section 33 4100 "Storm Utility Drainage Piping."

B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, non-biodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft..

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Hydrotech, Inc.
   b. Carlisle Coatings & Waterproofing Inc.
   c. Grace Construction Products; W.R. Grace & Co. -- Conn.

2.05 INSULATION

A. Insulation, General: Comply with Section 07 2100 "Building Insulation."

B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square] or shiplap edged.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Kingspan Insulation.
   d. Owens Corning.
2. Type IV, 25-psi minimum compressive strength.

2.06 PIPE PENETRATION ACCESSORIES

A. Galvanized Steel Wall Sleeve

1. Provide galvanized steel wall sleeve sized for specific pipe or conduit per manufacturers recommendations.
2. Provide sleeves with integral waterstop fin.
3. Extend sleeve past wall face as indicated on detail.
4. Provide sleeves similar to “Wall Sleeves” by Flexicraft.

B. Hydro-Expansive Waterstop

1. Provide a swellable polymer/butyl rubber waterstop strip installed on the wall sleeve at the waterstop fin as indicated on detail.
2. Provide waterstop similar to Adcor 500 by W. R. Grace.

C. Pipe Penetration Mechanical Seal

1. Provide a mechanically tightened, expanding permanent water seal in wall sleeve at each pipe or conduit through sheet waterproofing as indicated on detail.
2. Seal shall be rated to withstand 20 PSI.
3. Provide seal similar to Flexicraft “Pipeseal”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
   1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
   1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
      b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturers written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Re-prime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.

E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

G. Seal edges of sheet-waterproofing terminations with mastic.

H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

J. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels and Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.04 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation before installing drainage panels.

3.05 INSULATION INSTALLATION

A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.

B. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturers written instructions.

C. On horizontal surfaces, loosely lay insulation units according to manufacturer’s written instructions. Stagger end joints and tightly abut insulation units.

3.06 FIELD QUALITY CONTROL

A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Prepare test and inspection reports.

3.07 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation and drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 1900
WATER REPELLENTS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals for Review: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Include product description and performance characteristics.
   2. Warranty: Sample warranty form.

1.02 QUALITY ASSURANCE

A. Mockup:
   1. Determine coverage rate for application.
   2. After curing, water test to verify sufficient coverage to repel moisture from surface.
   3. Verify that application of coating to substrate will not produce surface stains or discoloration.
   4. **Ensure to apply to masonry mockup panel**.

1.03 PROJECT CONDITIONS

A. Do not apply coating if:
   1. Ambient or surface temperature is below freezing.
   2. Possibility of entrapped or frozen water exists.
   3. Rain is expected during next 72 hours.
B. Do not apply during high winds.
C. Prevent overspray onto adjacent materials.

1.04 WARRANTIES

A. Furnish manufacturer's 5-year warranty providing coverage against failure of coating to repel water.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. BASF. (www.buildingsystems.basf.com)
   2. L&M Construction Chemicals, Inc. (www.lmcc.com)
   3. Pecora Corp. (www.pecora.com)
   4. ProSoCo, Inc. (www.prosoco.com)

2.02 MATERIALS

A. Water Repellent:
   1. Solvent based.
   2. Contain minimum 20 percent siloxane by weight.

3. Produce water repellent effect without altering color or texture of substrate.
4. Water repellency: Minimum 80 percent reduction in water absorption from control sample, tested to ASTM E514.
5. Water vapor transmission: Maximum 10 percent reduction from control sample, tested to ASTM E96.
6. Source: Weather Seal Siloxane; ProSoCo, Inc.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces; remove loose and foreign matter that could impede penetration or performance of coating.
B. Allow surfaces to dry completely before beginning application.

3.02 APPLICATION

A. Follow manufacturer's instructions.
B. Apply at rate recommended by manufacturer unless otherwise determined by testing of mockup.
C. Apply in two coats.
D. Apply to following surfaces: Brick and concrete unit masonry.

3.03 FIELD QUALITY CONTROL

A. After coating has dried, test surfaces with water spray; reapply to any areas showing water absorption.

END OF SECTION

SECTION 07 2100
BUILDING INSULATION

PART 1 – GENERAL

1.01 SUBMITTALS

A. General: Submit in accordance with Section 01 3300 - Submittal Procedures.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.02 SUMMARY

A. Section Includes:

1. Blanket batt insulation.
2. Safing insulation.
3. Rigid board insulation.
4. Spray polyurethane foam insulation.

B. Related Sections:

1. Section 04 4200 – Unit Masonry
2. Section 07 8443 – Joint Firestopping.
4. Section 07 5500 – SBS Modified Bituminous Membrane Roofing
5. Section 09 2900 - Gypsum Board Assemblies: Sound attenuation batts.
6. Division 23 – Basic Mechanical Requirements.
7. Division 23 - Mechanical Requirements and Pipe and duct insulation

1.03 QUALITY ASSURANCE

A. Performance Limitations:

1. Certain cellular plastics used in building construction, though tested in conformance under ASTM and NFPA criteria, have been considered by the Federal Trade Commission as performing differently under actual fire conditions than under test conditions. Such products, if allowed to remain exposed or unprotected, may produce rapid flame spread, quick flashover, toxic or flammable gases, dense smoke and intense and immediate heat and may present a serious fire hazard. Architects are cautioned to thoroughly investigate these materials and their installation prior to specifying insulation products.
2. Materials used to insulate and fireproof buildings shall contain no asbestos.

B. Thermal Conductivity:

1. Insulation values are for a thermal conductivity (k-value) measured at 75o F.
2. Adjust thicknesses as required when using material having a different thermal conductivity or tested at a different temperature.
3. Where insulation is specified to have a specific "R" value, furnish manufacturer's standard thickness required to equal or exceed the specified value.
4. Insulation "R" Values:
   a. Walls:
      1) R = 19 minimum above grade.
      2) R = 10 minimum below grade.
   b. Roofs: R = 30 average.

c. Soffits: R = 19 minimum.

d. Above-Grade Slabs over Unheated Spaces: R = 19 minimum.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not deliver plastic insulation materials to the project site prior to time of installation. Protect at all times against ignition. Complete the installation and concealment of plastic materials as rapidly as possible.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Batt Insulation:
1. Owens-Corning Fiberglass.
2. U.S. Gypsum.
3. Schuller International, Inc.
4. Certain Teed Corp.

B. Rigid Insulation:
1. Dow Chemical Co.
2. Amoco.
3. Celotex Corp.
4. Schuller International, Inc.
5. U.C. Industries.

C. Spray Foam Insulation
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or equal:
a. BaySystems North America, LLC; Bayseal CC.
b. ERSystems, Inc.; Spray Polyurethane Foam.
c. Henry Company; Permax SPF.
d. Volatile Free, Inc.; VFI-714.

2.02 MATERIALS

A. Foil Faced Batt Insulation:
1. Resilient glass fibers bonded with thermosetting resin to foil facing.
2. Batts shall have minimum R-Value of 3.0 per inch of insulation thickness.
3. Vapor Transmission: Not more than 0.1 perms.
4. Comply with ASTM C665, Type III.
5. Install foil faced insulation in such a way to ensure integrity of vapor barrier. Tape all joints, penetrations, and at top and bottom of walls.
6. Where not covered with a 15 minute thermal barrier, provide batts, including vapor barrier, not exceeding a flame spread of 25 or smoke developed of 50 per ASTM E84; & rated noncombustible per ASTM E136.

B. Rigid Insulation for Above-Grade Walls and Miscellaneous Locations:
1. Extruded Polystyrene Board Insulation: ASTM C578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
a. Comply with UL systems as noted on drawings.
b. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
c. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

d. Board Size: 48 x 96 inch.

e. Board Thickness: 2 inches.

f. Thermal Conductivity (k factor) at 25 degrees F: 0.18.

C. Rigid Insulation for Roofing Locations:

1. Type: ASTM C1 289, Type II, rigid polyisocyanurate faced both sides with glass fiber mat facings.
2. Type: ASTM C728, rigid expanded perlite.
3. Edges: Square.
4. Thickness: Polyisocyanurate 4 inches; DensDeck 1/2 inch.
5. Provide board tapered to 1/4 inch per foot.

D. Cavity Wall Insulation:

1. Extruded Polystyrene (XPS) Board, Type IV-: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
   a. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

E. Safing Insulation:

1. Conform to ASTM C612, Class 1 and 2, (melt point of over 2,000o F.). Provide USG "Thermafiber Safing Insulation", or approved substitute, thickness as required.
2. Contract Documents must clearly show locations and detail.

F. Spray Polyurethane Foam Insulation:

1. Open-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, Class 1A Fire-Rated with maximum flame-spread & smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
   a. Provide intumescent ignition barrier coating per local code requirements.
2. Minimum density of 1.5 lb./cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
3. Thermal Resistance, ASTM C-518:
   a. R-3.7 per 1 inch thickness.
4. Moisture Vapor Transmission (permeance) ASTM E-96:
   a. Impermeable at 3.5 inch thickness.

2.03 ACCESSORIES

A. Tape: Minimum 2 inches wide, pressure sensitive, foil faced, waterproof.

B. Impale Fasteners: Steel impaling fasteners on metal base with lock washers, length to suit insulation thickness.

C. Wire Mesh: Hexagonal steel wire, galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All exposed exterior building columns and beams shall be insulated from the interior at the same R = 19 rating as for walls.

B. Insulate above-grade floor slabs where underside is exposed to the weather or unheated space to achieve an R = 19 rating minimum.

C. Tape joints for the rigid insulation using the manufacturer’s recommended tape.

D. Insulate around support and support cross-beams.

E. Spray foam insulate exposed decking at underside of conditioned areas.

END OF SECTION

SECTION 07 2600
VAPOR BARRIERS AND RETARDERS – BELOW SLAB

PART 1 – GENERAL

1.01 SUBMITTALS

A. General: Submit following items under provisions of Section 01 6000 - Product Requirements.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.02 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 6000 – Product Requirements.

B. Deliver, store, handle and protect in accordance with manufacturer's recommendations for handling.

1.05 SEQUENCING

A. Begin installation only after substrate work is complete and penetrations are securely anchored.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Tear Resistant Vapor Retarder:

1. Acceptable Products:

a. Stego Wrap 15 mil, Stego Industries.

b. Griffolyn T-85 by Reef Industries

c. Rufco D16WB by Raven Industries Moistop, Fortifiber Corporation, Los Angeles, CA.

d. VaporMat 15 mil by WR Meadows.

B. Joint Tape: Manufacturer’s recommended, pressure sensitive type, self-adhering, and of perm rating not less than vapor retarder.

C. Gusset Tape: Provide manufacturer's recommended 6 inch gusset tape.

D. Adhesive: Type recommended by manufacturer of sheet products, non-sagging grade, compatible with sheet and substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 4000 – Quality Requirements.

B. Verify that substrate work is complete, clean and dry before beginning installation of sheet products.

3.02 INSTALLATION

A. Under Slab-on-Grade:

1. Vapor Retarder: Lay-out sheets to minimize quantity of joints. Lap edge and end joints 6 inches minimum and continuously seal with joint tape.

2. Turn up sheets at perimeter; at footers and vertical walls, and against penetrations. Seal joints with tape.

3.03 PROTECTION

A. Protect sheets from puncture during installation. Patch punctures before proceeding with subsequent construction.

B. Install runway planks in construction traffic lanes until slabs are poured.

END OF SECTION

SECTION 07 2800
WEATHER BARRIER

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Submittal Procedures. Submit manufacturer's descriptive data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. DuPont. (www.tyvek.com)
   2. Huber Engineered Woods LLC. website: www.ZIPSystem.com
   3. Or an approved equal.

2.02 MATERIALS

A. Weather Barrier:
   1. Source No. 1: Tyvek Commercial Wrap by DuPont.
   2. Source No. 2: Zip System with tape by Huber Engineered Woods LLC.

2.03 ACCESSORIES

A. Fasteners: Hot-dip galvanized or fluoropolymer coated steel screws with 1 inch diameter plastic washers, minimum 5/8 inch penetration into framing.
B. Joint Tape: Minimum 2 inches wide, pressure sensitive, waterproof, of type recommended by weather barrier manufacturer.
C. Flashing Sheet: Type recommended by weather barrier manufacturer.
D. Primer: Type recommended by weather barrier manufacturer.
E. Patching Compound: Type recommended by weather barrier manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide complete and continuous barrier.
B. Install weather barrier without tears, voids, and holes.
C. Begin application at low point; weatherlap succeeding courses minimum 4 inches.
D. Lap ends 6 inches minimum. Tape seal lapped ends and edges.
E. Fasten at maximum 12 inches on center.
F. Seal to door & window frames, around penetrations, & at perimeter with flashing sheet. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

3.02 FIELD QUALITY CONTROL

A. Inspect weather barrier for damage just prior to covering.
B. Clean damaged areas and cover with additional weather barrier material minimum 6 inches larger than damaged area on all sides. Seal to main weather barrier with continuous tape.

END OF SECTION

SECTION 07 4113
METAL ROOF, WALL AND SOFFIT PANELS

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Design Requirements; design roof system to withstand:
   1. Live and dead loads in accordance with Building Code.
   2. Minimum wind pressures in accordance with ASCE 7.

B. Performance Requirements; Water leakage: None, tested to ASTM E 331 with test pressure of 6.24 PSF.

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Submittal Procedures.
   1. Shop Drawings: Show configuration of panels, trim members, and closures.
   2. Product Data: Show system components including panels, trim, and accessories.
   3. Samples: 3 x 3 inch finish samples showing available colors.
   4. Warranty: Sample warranty form.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this section.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect panels from contact with materials that could cause staining or discoloration of finish.

1.05 PROJECT CONDITIONS

A. Do not install underlayment at ambient or surface temperatures less than 40 degrees F or on wet or frozen substrate.

B. Do not install panels on wet or frozen substrate.

1.06 WARRANTIES

A. Furnish manufacturer’s 20-year warranty providing coverage against chipping, cracking, fading, or delamination of panel finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Preferred Manufacturer: Sheffield Metals Snap-Lock as Basis-of-Design - (www.sheffieldmetals.com)

B. Acceptable Manufacturers:
   1. AEP-Span. (www.aep-span.com)
   2. Berridge Manufacturing Co. (www.berridge.com)
   3. Centria Architectural Systems. (www.centria.com)
   4. Fabral. (www.fabral.com)
   5. MBCI. (www.mbci.com)
   6. Petersen Aluminum Corp. (www.pac-clad.com)

2.02 MATERIALS

A. Galvanized Steel Sheet: ASTM A653, Structural Quality, G90 coating class.

B. Underlayment: Tamko TW Metal and Tile underlayment, ASTM D1970, fiberglass reinforced, self-adhering rubberized asphalt sheet membrane.

C. Metal Mesh Panels: Expanded Metal, Stainless Steel Type 316, 1/2 #16 Flattened, 60% Open Area, Sheet, 48.0000" Width x 96.0000" Length, Long Way of Opening Parallel to: Length, Metal Wall Panels applied as the cladding over wall framing specified in 05 4000 - Cold-Formed Metal Framing.

D. Accent Metal Panels: Grade 80 full hard steel, corrugated galvanized metal panels.

2.03 ACCESSORIES

A. Fasteners:

1. Underlayment: Plastic-capped Hot-dip galvanized steel nails (as needed), length to penetrate minimum 3/4 inch into sheathing.
2. Panels and Trim: 300 Series stainless steel, type best suited to application; head color to match panels where exposed, with neoprene gasketed washers.

B. Panel Clips: Hot-dip galvanized steel, designed to fit between two adjacent panels and secure both panels.

C. Panel End Closures: Sponge neoprene, cut to fit panel configuration, minimum 1 inch depth.

D. Joint Sealers: Specified in Section 07 9200.

2.04 FABRICATION

A. Fabricate panels from minimum 24 gage galvanized steel sheet.

B. Standing-seam Panel Profile: 2 inch high standing seams spaced 12 to 16 inches on center with interlocking edges (Optional Mechanically Seamed).

C. Wall & Soffit Panel Profile: 12" wide by 1-1/2" depth with concealed fasteners and interlocking sidelap. Profile shall have two vee grooves spaced at 4" o.c., vented panels, factory formed, continuous lengths.

1. Panel Attachment: Concealed clips,
2. Panel Substrate: 3/4” Plywood, C-D/Exposure 1-APA, Rated Sheathing 16/0 span rating.
3. Exterior Panel Finish: Smooth, Flat Finish.
4. Interior Panel Finish: Smooth, Flat Finish.
5. Exterior Panel Gauge: 24.

D. Trim: Profiles as indicated or as required, fabricated from same material as panels.

E. Roll form panels and trim to required profiles in longest practical lengths.

2.05 FINISHES

A. Panels and Trim: Fluoropolymer coating, AAMA 2605, containing minimum 70 percent PVDF resins applied to sheets in coil form, color to be galvalume.

PART 3 - EXECUTION

3.01 INSTALLATION OF UNDERLAYMENT

A. Starting at low edge, apply one ply of underlayment horizontally over substrate.

B. Weather lap each strip 6 inches minimum over previous strip.

C. Lap ends 6 inches minimum.

D. Fasten top of each strip under overlapping strip to hold strip in position until roofing panels are installed.
E. Provide 18 inch weave pattern at valleys.
F. Lap underlayment minimum 12 inches over hips and ridges from both sides. Apply 36 inch wide strip centered lengthwise over ridge. Nail at 12 inches on center on each side.
G. Extend minimum 4 inches up abutting vertical surfaces.

3.02 INSTALLATION OF METAL PANELS

A. Install in strict accordance with manufacturer's written instructions and recommendations.
B. Install aligned, level, and plumb.
C. Fasten panels using concealed panel clips.
D. Install panels in continuous lengths from eave to ridge without end joints.
E. Install trim to maintain visual continuity of system.
F. Install joint sealers and gaskets to prevent water penetration.
G. Flash penetrations through roofing with metal trim to match panels:
    1. Lap flashings over roof panels 12 inches minimum on all sides and seal with double bead of joint sealer.
    2. Install metal draw band and joint sealer at top of pipe penetrations.
    3. Install water diverter at uphill side of square and rectangular penetrations.
H. Installation Tolerances:
    1. Variation from location: Plus or minus 1/4 inch.
    2. Variation from plane: 1/4 inch in 10 feet.

3.03 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.04 ADJUSTING

A. Touch up field cuts and abrasions on finished surfaces to match factory finish.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Show locations, types and thicknesses of metal, profiles, and dimensions, fastening methods, provisions for expansion and contraction, and joint details.

1.02 QUALITY ASSURANCE

A. Design, fabricate, and install copings, gravel stops, and edge flashings in accordance with ANSI/SPRI ES-1.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Precoated Galvanized Steel Sheet:
   1. ASTM A653, Structural Quality, G90 coating class, 24 gage core steel unless noted otherwise.
   2. Finish: Precoated with fluoropolymer coating, containing minimum 70 percent PVDF resins, color to be selected from manufacturer's full color range.

B. Lead Sheet: ASTM B749, Type L50049, common lead, weighing 4 pounds per square foot.

2.02 ACCESSORIES

A. Solder: ASTM B 32.

B. Fasteners: Stainless steel, with neoprene gasketed washers where exposed.

2.03 FABRICATION

A. Fabricate components in accordance with SMACNA Manual.

B. Fabricate corners in single units with minimum 18 inch long legs.

C. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

D. Form sections accurate to size and shape, square and free from distortion and defects.

E. Provide for thermal expansion and contraction in sheet metal:
   1. Gutters:
      a. Place expansion joints at maximum 50 feet on center.
      b. Locate expansion joints between downspouts; prevent water flow over joint.
   2. Other sheet metal:
      a. Provide expansion joints in sheet metal exceeding 15 feet in running length.
      b. Place expansion joints at 10 feet on center maximum and maximum 2 feet from corners and intersections.
   3. Joint width: Consistent with types and sizes of materials, minimum width 1/4 inch.

F. Fabricate expansion joints in metal copings, edge flashings, and gravel stops with cover plates formed to flashing profile and minimum 4 inches long.
G. Unless otherwise indicated, provide minimum 3/4 inch wide flat lock seams; lap in direction of water flow.
H. Fabricate cleats and starter strips of same material as sheet metal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install flashing and sheet metal as indicated and in accordance with SMACNA Manual.
B. Install cleats and starter strips before starting installation of sheet metal.
C. Expansion Joints in Metal Copings, Edge Flashings, and Gravel Stops:
   1. Seal expansion space between ends of flashing sections.
   2. Apply continuous bead of joint sealer between cover plate and flashing sections at each end.
D. Secure flashings with concealed fasteners where possible.
E. Apply plastic cement between metal and bituminous flashings.
F. Fit flashings tight, with square corners and surfaces true and straight.
G. Seam and seal field joints.
H. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.
I. Reglets:
   1. Install reglets true to line and level. Seal top of surface mounted reglet with joint sealer.
   2. Install flashings into reglets to form tight fit. Secure with lead or plastic wedges at 9 inches on center maximum. Seal remaining space with joint sealer.
J. Gutters: Secure with straps spaced maximum 36 inches on center and within 12 inches of ends.
K. Downspouts:
   1. Secure with straps spaced maximum 8 feet on center and within 2 feet of ends and elbows.
   2. Flash downspouts minimum 3 inches into gutters, conductor heads, and fasten.
   3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.

3.02 CLEANING

A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

END OF SECTION

SECTION 07 6500
FLEXIBLE FLASHING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Self-adhering flexible flashings used in building assemblies.
B. Related Requirements:
   1. Section 01 4000 – Quality Requirements “Mock-Ups” for construction of integrated exterior mock-ups erected separately from the building envelope.
   2. Section 07 6200 - Sheet Metal Flashing and Trim for metal flashings used in building assemblies.

1.03 COORDINATION

A. Coordinate flexible flashing layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
B. Coordinate flexible flashing installation with adjoining wall materials, joints, and seams to provide leakproof and secure installation.

1.04 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
B. Shop Drawings of flashings in integrated exterior mock-up: Submit shop drawings of proposed wall assembly mock-ups showing locations of flexible flashings in wall assemblies.
C. Samples: For each type of material specified.
D. Qualification Data: For fabricator.
E. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer: Obtain materials from single manufacturer regularly engaged in manufacturing self-adhering flexible flashing products. Obtain secondary products from a source acceptable to primary flexible flashing manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver flashing materials to project site in original packaging, labeled with manufacturer’s information, product name, date of manufacture, and directions for storage.
B. Store flashing materials in original undamaged packaging or in a clean dry protected location and within the temperature range required by the manufacturer. Protect stored materials from direct sunlight.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide flashing membrane that meets performance requirements of ICC-ES ACI-48, “Acceptance Criteria for Flexible Flashing Materials”. Test reports from accredited testing laboratories shall be made available upon request.
   1. Connections to Adjacent Materials: Provide connections to prevent air leakage.

2.02 SELF-ADHERING FLEXIBLE FLASHING MEMBRANE

A. Self-Adhering Flexible Flashing Membrane: Composite, self-adhering flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
   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. Hohmann & Barnhard - Textroflash.
      b. GreenGuard - Butyl Flashing or SuperStretch Butyl Flashing.
      c. DuPont - FlexWrap
      d. Grace Construction Products - Vycor Butyl Self-Adhered Flashing
      e. COPPER-TUFF
   2. Water Intrusion (ASTM E331): No leakage at 75 Pa.
   3. Water Vapor Permeability (ASTM E96): Less than 1 perm.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of miscellaneous items as required for complete installation and as recommended by manufacturer.
B. Sealant Tape: Pressure-sensitive,
C. Air Barrier Sealant: Sealants and adhesives compatible with flexible flashing material used to complete the flashing assembly and acceptable to the flashing manufacturer.
D. Primers: As required by flashing manufacturer to prepare substrates for flexible flashing adhesion.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Install wall flashing to intercept and exclude penetrating moisture. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers. Follow manufacturer's installation instructions.

B. Prime substrates as recommended by flashing manufacturer.

C. Lap seams and junctures with other materials at least 4 inches.

1. Exception: Lap seams need not exceed flashing flange depth of other construction.

D. Lap flashing over water-resistive barriers at bottom and sides of openings.

E. Lap water-resistive barrier over flashing at heads of openings.

F. After flashing has been applied, roll surfaces to ensure complete adhesion to substrates.

3.03 CLEANING AND PROTECTION

A. Protect flashings from damage during storage, installation and remainder of the construction period.

B. Coordinate with installation of exterior cladding to ensure exposure period is limited to range permitted by manufacturer.

C. Replace damaged flashings.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit manufacturer's literature including description of materials, finishes, operation, and installation instructions.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant and field assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on samples of size to adequately show color.

D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

1.02 SUMMARY

A. Section Includes:

1. Equipment supports.
2. Pipe and duct supports.

B. Related Sections:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.03 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.04 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.02 EQUIPMENT SUPPORTS

A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.
   1. The Pate Company.
   2. Thybar Corporation.
   3. Greenheck Fan Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
   1. Finish: Mill phosphatized.

D. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.
   2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
   3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
   4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide under top flange on side of curb, continuous around support perimeter.
   5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
   6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
   7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
   8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
   10. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.03 PIPE AND DUCT SUPPORTS

A. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with stainless-steel roller carrying assembly accommodating up to 7-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

2.04 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
   1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

E. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

F. Steel Tube: ASTM A 500/A 500M, round tube.

G. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to STM A 123/A 123M.

H. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.05 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
H. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.06 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
C. Verify dimensions of roof openings for roof accessories.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
   3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
C. Roof Curb Installation: Install each roof curb so top surface is level.
D. Equipment Support Install: Install equipment supports so top surfaces are level with each other.
E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and

attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

F. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

G. Roof Walkway Installation:

1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.

H. Seal joints as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 9100 "Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 8400
PENETRATION FIRESTOPPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Through-penetration firestopping in fire-rated barriers including both empty openings and openings containing cables, pipes, ducts, conduits and other penetrating items.
2. Construction-gap firestopping at connections of the same or different materials in fire-rated construction using fire-resistant sealants.
3. Construction-gap firestopping occurring within fire-rated walls using fire-resistant sealants.
4. Construction-gap firestopping occurring at the top of fire-rated walls.

B. Related Sections:
1. Section 07 2100 - Building Insulation: Fibrous fire-safing insulation.
2. Section 07 9200 - Joint Sealers.
4. Division 23 - Mechanical: Fire dampers and manufactured mechanical devices.
5. Division 26 - Electrical: Raceway seals, cable trays and manufactured electrical devices.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. General:
1. Provide firestopping systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems:
1. Provide through-penetration firestop systems with F ratings required, as determined per ASTM E814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems:
1. Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
a. Where firestop systems protect penetrations located outside of wall cavities.
b. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
d. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. Fire-Resistive Joint Sealants:
1. Provide joint sealants with fire-resistance ratings required, as determined per ASTM E119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. Exposed-to-View Firestopping Materials:
1. For firestopping exposed to view, traffic, moisture, UV radiation, and physical damage, provide products that do not deteriorate when exposed to these conditions.
a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

b. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

c. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke developed values of less than 450, as determined per ASTM E84.

1.03 SUBMITTALS

A. Certifications:

1. Submit manufacturer's certification that materials supplied are in accordance with the specifications and requirements of the authorities having jurisdiction.
2. Submit certification that materials supplied are VOC compliant and are nontoxic to building occupants.

B. Test Reports:

1. Submit product test reports from, and based on tests performed by, a qualified testing and inspecting agency who is acceptable to the Architect/Engineer and is licensed in the State of Texas .

C. Penetrations Schedule:

1. Submit a schedule showing typical penetrations of each penetrating material type, firestopping type to be used, F ratings, T ratings, UL or other acceptable testing agency reference numbers, and other pertinent data.

1.04 QUALITY ASSURANCE

A. Fire-Test Response Characteristics:

1. Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

a. Perform firestopping tests by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to the code official.

b. Through-penetration firestop systems must be identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of a least 0.01" of water is maintained at a distance of 0.78" below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:

1) Furnish products bearing classification marking of qualified testing and inspecting agency.

2) Furnish firestop systems corresponding to those indicated by reference to system designations listed by UL in their "Fire Resistance Directory" or by Warnock Hersey.

c. Fire-resistive joint sealant systems must be identical to those tested for fire-response characteristics per ASTM E119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:

1) Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory."

2) Furnish joint sealants, including backing materials bearing classification marking of qualified testing and inspection agency.

B. Information on Drawings:
   1. Drawings refer to specific design designations of through-penetration firestop systems intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing performance of proposed substitutions equals or exceeds that of systems they would replace and are acceptable to authorities having jurisdiction.
C. Standards:
   1. Conform to applicable standards, including, but not limited to:
      a. ASTM E119 Method for Fire Tests of Building Construction and Materials.
      b. ASTM E814 Test Method of Fire Tests of Through-Penetration Firestops.
D. Installer Qualifications:
   1. Installer who has successfully completed within the last three years at least three firestopping applications similar in type and size to that of this project.
E. Single Source for Materials:
   1. Obtain firestopping materials from a single manufacturer for each different product required.
F. Preconstruction Laboratory Tests:
   1. Submit substrate materials representative of actual joint surfaces to be sealed to manufacturer of firestopping products for laboratory testing of firestop materials for adhesion to primed and unprimed substrate joints and for compatibility with secondary seals, if required, as indicated below:
      a. Use test methods standard with manufacturer to determine if priming and other specific substrate preparation techniques are required to obtain rapid, optimum adhesion of firestopping to substrate joints under environmental conditions that will exist during actual installation.
      b. Testing will not be required when firestopping manufacturer is able to submit preparation data required above which is based on previous testing of current firestopping products for adhesion to, and compatibility with, substrates matching those submitted.
G. Detectable Asbestos:
   1. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

1.05 WARRANTY

A. Submit 2 copies of written 2-year warranty agreeing to repair or replace firestopping which fails to perform as airtight and watertight joints; or fails in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appears to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.
B. Provide warranty signed by the Installer and Contractor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products by one of the following for each different product required:
   1. 3M Fire Protection Products
   2. Bio-Fireshield Inc.
   3. General Electric Company

4. Tremco, Inc.
5. Hilti Inc.
6. Other approved manufacturer's offering UL listings will be considered.

2.02 MATERIALS

A. Compatibility:
1. Provide firestopping, joint fillers, dams and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Accessories:
1. Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part
a. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
2. Permanent forming/damming/backing materials including the following:
a. Semi-refractory fiber (mineral wool) insulation.
b. Ceramic fiber.
c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
1) Fire-rated formboard.
2) Joint fillers for joint sealants.
d. Fire-Rated Back-up for Fire-Resistant Joint Sealers: "Ultra Block" by Backer Rod Manufacturing and Supply Co.
e. Temporary forming materials.
f. Substrate primers.
g. Collars.
h. Steel sleeves.

C. Applications:
1. Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

PART 3 - EXECUTION

3.01 PENETRATION SCHEDULE

A. General:
1. Prepare a schedule showing typical penetrations of each penetrating material type and other information as follows:
a. Project Name.
b. Construction Type.
c. Occupancy.
d. Firestop Applicator.

B. Construction Assemblies:
1. Gypsum Board Walls

2. CMU and Concrete Walls
3. Concrete Floors
4. Floor/Ceiling Assemblies
5. Roof/Ceiling Assemblies
6. Shafts
7. Chases
8. Curtain Walls
9. Construction Joints
10. Expansion Joints

C. Fire Resistive Rating Requirements:
1. Furnish the following information for each type of construction assembly listed above:
a. Hourly fire rating.
b. "F" Rating.
c. "T" Rating.
d. Qualified testing agency Design No.
e. Penetrating item.
f. Penetrating material and size.
g. Minimum annular space.
h. Maximum annular space.
i. Architect's detail and sheet number.
j. Shop drawing detail or sheet number.

3.02 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted labels as recommended by manufacturer. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. At a minimum, the labels shall include the following information
1. Contractor’s name, address, and phone number
2. Through-penetration firestop system designation of applicable testing and inspecting agency
3. Date of installation
4. Through-penetration firestop system manufacturer’s name
5. Installer’s name

END OF SECTION

SECTION 07 8443
JOINT FIRESTOPPING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: For each type of product.
   2. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
      a. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire resistance-rated assembly.

1.02 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.
   2. Joints at exterior curtain-wall/floor intersections.
   3. Joints in smoke barriers.
B. Related Requirements:
   1. Section 07 8400 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
   2. Section 07 9513 "Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
   3. Section 07 9513 " Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
   4. Section 09 2900 "Gypsum Board Assemblies" for firestop tracks for metal-framed partition heads.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.05 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."

2.02 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Roxul Inc.
      d. Tremco, Inc.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Roxul Inc.
      d. Tremco, Inc.
   2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Roxul Inc.
      d. Tremco, Inc.
   2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
   1. Sealant shall have a VOC content of 250 g/L or less.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with

adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 07 9200
JOINT SEALERS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use.

1.02 PROJECT CONDITIONS

A. Do not apply sealers at temperatures below 40 degrees F unless approved by sealer manufacturer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. BASF Building Systems. (www.buildingsystems.basf.com)
   2. Dow Corning Corp. (www.dowcorning.com)
   3. GE Silicones. (www.gesealants.com)
   4. Pecora Corp. (www.pecora.com)
   5. Sika Corp. (www.sikausa.com)
   6. Tremco, Inc. (www.tremcosealants.com)

2.02 MATERIALS

A. Joint Sealer Type 1:
   1. ASTM C920, Grade P, multiple component polyurethane type, self-leveling and slope grades.
   2. Movement capability: Plus or minus 50 percent.
   3. Color: To be selected from manufacturer's full color range.

B. Joint Sealer Type 2:
   1. ASTM C920, Grade NS, multiple component silicone type, non-sag.
   2. Movement capability: Plus or minus 25 percent.
   3. Color: To be selected from manufacturer's full color range.

C. Joint Sealer Type 3:
   1. ASTM C834, single component acrylic latex, non-sag.
   2. Movement capability: Plus or minus 7-1/2 percent.
   3. Color: White.

D. Joint Sealer Type 4:
   1. ASTM C920, Grade NS, single component silicone, non-sag, mildew resistant.
   2. Movement capability: Plus or minus 25 percent.
   3. Color: To be selected from manufacturer's full color range.

E. Joint Sealer Type 5:
   1. ASTM C834, single component acrylic latex, non-sag, non-hardening, recommended by manufacturer for acoustical applications.
   2. Movement capability: Plus or minus 7-1/2 percent.
   3. Color: White.

2.03 ACCESSORIES

A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.

B. Joint Backing:

1. ASTM C 1330, closed cell polyethylene foam, preformed round joint filler, non-absorbing, non-staining, resilient, compatible with sealer and primer, recommended by sealer manufacturer for each sealer type.
2. Size: Minimum 1.25 times joint width.

2.04 MIXES

A. Mix multiple component sealers in accordance with manufacturer's written instructions.

1. Mix with mechanical mixer; prevent air entrainment and overheating.
2. Continue mixing until color is uniform.

PART 3 – EXECUTION

3.01 PREPARATION

A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Protect adjacent surfaces with masking tape or protective coverings.

3.02 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations.

B. Install sealers and accessories in accordance with ASTM C 1193.

C. Install acoustical sealers and accessories in accordance with ASTM C 919.

D. Install joint backing to maintain required sealer dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.

E. Use bondbreaker tape where joint backing is not installed.

F. Fill joints full without air pockets, embedded materials, ridges, and sags.

G. Tool sealer to smooth profile.

H. Apply sealer within manufacturer’s recommended temperature range.

3.03 CLEANING

A. Remove masking tape and protective coverings after sealer has cured.

B. Clean adjacent surfaces.

3.04 SCHEDULE

JOINT LOCATION OR TYPE	SEALER TYPE
Exterior Joints:	
Joints in horizontal surfaces subject to pedestrian or vehicular traffic	1
Joints in above-grade surfaces	2
Interior Joints:	
Joints in horizontal surfaces subject to pedestrian traffic	1
Joints in toilet rooms, countertops, and break rooms	4
Joints in acoustical assemblies	5
Other joints	3

END OF SECTION

SECTION 07 9500
EXPANSION CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior expansion control systems.
   2. Exterior wall expansion control systems.

B. Related Requirements:
   1. Section 07 2726 “Fluid-Applied Air and Water-Resistant Barrier System" for liquid-applied joint sealants in fire-resistive building joints.
   2. Section 07 9200 "Joint Sealers" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
   2. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches long in size.

C. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   4. Movement capability.
   5. Classification as thermal or seismic.
   6. Materials, colors, and finishes.
   7. Product options.
   8. Fire-resistance ratings.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

2.03 INTERIOR EXPANSION CONTROL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
   2. Balco, Inc.
   3. Construction Specialties, Inc.
   4. JointMaster/InPro Corporation.
   5. Michael Rizza Company, LLC.
   6. MM Systems Corporation.
   7. Nystrom, Inc.
   8. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
C. Wall-to-Wall:
   1. Manufacturer: Construction Specialties, Inc.
   2. Type: ASM Series
   3. Nominal Width: 1"
D. Wall Corner:
   1. Manufacturer: Construction Specialties, Inc.
   2. Type: ASMC Series
   3. Nominal Width: 1"
E. Ceiling-to-Ceiling: (Gypsum ceiling)
   1. Manufacturer: Construction Specialties, Inc.
   2. Type: ASM Series
   3. Nominal Width: 1"
F. Ceiling-to-Ceiling: (Acoustical ceiling)
   1. Manufacturer: Construction Specialties, Inc.
   2. Type: ASM Series
   3. Nominal Width: 1"

2.04 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
   2. Balco, Inc.
   3. Chase Construction Products; Division of Chase Corporation.

4. Construction Specialties, Inc.
5. D. S. Brown Company (The).
6. EMSEAL Corporation.
7. Erie Metal Specialties, Inc.
8. JointMaster/InPro Corporation.
9. LymTal International, Inc.
10. Michael Rizza Company, LLC.
11. MM Systems Corporation.
12. Nystrom, Inc.
13. RJ Watson, Inc.
14. Schul International Company, Inc.
15. Tremco Incorporated.
16. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
17. Williams Products, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
1. Manufacturer: Construction Specialties, Inc.
2. Type: HS Series
3. Nominal Width: 1"

D. Wall Corner:
1. Manufacturer: Construction Specialties, Inc.
2. Type: HS Series
3. Nominal Width: 1"

E. Roof-to-Wall:
1. Manufacturer: Construction Specialties, Inc.
2. Type: RJTW
3. Nominal Width: 1"

2.05 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.

2.06 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304 for plates, sheet, and strips.
1. Remove tool and die marks and stretch lines or blend into finish.

C. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.

E. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

F. Moisture Barrier: Flexible elastomeric material, [PVC, minimum 30 mils thick] [EPDM, minimum 45 mils thick] [Santoprene].

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

H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, or thicker.

2.09 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   5. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces before installing compression seals.

E. Foam Seals: Install with adhesive recommended by manufacturer.

F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not over-pressurize.

G. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

H. Moisture Barrier: Provide at all exterior joints. Provide drainage fittings at a maximum of 50 feet.

3.04 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Show locations, elevations, dimensions, model designations, thermal, ratings, preparation for hardware, and anchoring details.
   2. Product Data: Show elevations, dimensions, gages of metal, hardware reinforcing gages and locations, and anchor types.

B. Quality Control Submittals:
   1. Certificates of Compliance: Certification that doors and frames comply with specified thermal requirements.

1.02 QUALITY ASSURANCE

A. Doors: ANSI A250.8.
   1. Grade: II - Heavy Duty.
   2. Model: 2 - Seamless.
   3. Exterior doors: Minimum R value of 12.0.

B. Frames: ANSI A250.8, Grade II - Heavy Duty.

C. Fire Door and Frame Construction: Conform to UL 10C.

D. Installed Fire Rated Door and Frame Assemblies: Conform to NFPA 80.

1.03 DELIVERY, STORAGE AND HANDLING

A. Ship door frames with removable angle spreader; do not remove until frame is installed.

B. Store doors upright in protected, dry area, off ground or floor, with at least 1/4 inch space between individual units.

C. Do not cover with non-vented coverings that create excessive humidity.

D. Remove wet coverings immediately.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Amweld Building Products LLC. (www.amweld.com)
   2. Ceco Door Products. (www.cecodoor.com)
   3. Curries Company. (www.curries.com)
   4. Kewanee Corp. (www.kewaneecorp.com)
   5. Pioneer Industries, Inc. (www.pioneerindustries.com)
   6. Steelcraft. (www.steelcraft.com)

2.02 MATERIALS

A. Steel Sheet: ASTM A1008, cold rolled.

B. Galvannealed Steel Sheet: ASTM A 924, Class A60 galvannealed.

C. Door Core:
   1. Exterior doors: Foamed-in-place polyurethane insulation.
   2. Interior fire-rated doors: Rigid mineral fiberboard.
   3. Interior non-fire rated doors: Vertical steel stiffeners.
D. Batt Insulation: Mineral wool type.

2.03 FABRICATION

A. Fabricate doors and frames in accordance with ANSI A250.8.
B. Fabricate exterior doors and frames from galvannealed steel sheet.
C. Doors:
   1. Fabricate from minimum 18 gage sheets.
   2. Close top and bottom edges of doors with steel channel, minimum 16 gage, extending full width of door, and spot welded to both faces, with top channel flush and bottom channel recessed.
   3. Fill voids between vertical steel stiffeners with batt insulation.
D. Frames:
   1. Fabricate from minimum 16 gage sheets.
   2. Close corner joints tight with trim faces mitered, continuously welded, and ground smooth.
   3. Anchors:
      a. Provide one anchor at each jamb for each 30 inches of door height.
      b. Design anchors to provide positive fastenings to adjacent construction.
      c. Provide one floor anchor welded to each jamb.
E. Accurately form to required sizes and profiles.
F. Grind and dress exposed welds to form smooth, flush surfaces.
G. Do not use metallic filler to conceal manufacturing defects.
H. Fabricate with internal reinforcement for hardware specified in Section 08 7100; weld in place.
I. Glazing Stops:
   1. Manufacturer's standard, screw on type with mitered corners.
   2. Form stops from minimum 20 gage steel; prefit for field glazing.
   3. Locate screws within 1 inch of ends of stops and maximum 8 inches on center.
   4. Install glazing stops on secure side of frames.

2.04 FINISHES

A. Dress tool marks and surface imperfections to smooth surfaces.
B. Chemically treat and clean.
C. Touch up damaged metallic coatings.
D. Apply manufacturer's standard primer paint – Dark Bronze.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with ANSI A250.11.
B. Set plumb and level.
C. Secure to adjacent construction using fastener type best suited to application.
D. Install glass as specified in Section 08 8000.
E. Install hardware in accordance with Section 08 7100.

3.02 ADJUSTING

A. Touch up minor scratches and abrasions in primer paint to match factory finish.

END OF SECTION

SECTION 08 1423
PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Show locations, elevations, dimensions, and preparation for hardware.
   2. Samples:
      a. 6 x 6 inch door samples showing edges, core, and faces.
      b. 3 x 3 inch plastic laminate samples showing selected color.
   3. Warranty: Sample warranty form.

1.02 QUALITY ASSURANCE

A. Flush Wood Doors: AWI Premium Grade.
B. Fire Door Construction: Conform to UL 10C.
C. Installed Fire Rated Door Assembly: Conform to NFPA 80.

1.03 DELIVERY, STORAGE AND HANDLING

A. Package doors in heavy plastic with identifying marks; slit plastic wrap on site to permit ventilation, but do not remove from plastic until ready to install.
B. Store doors upright with at least 1/4 inch between doors, in protected, dry area.

1.04 WARRANTIES

A. Furnish manufacturer's Life-of-Installation warranty providing coverage against defects in materials and workmanship and warpage beyond specified amount.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Eggers Industries. (www.eggersindustries.com)
   2. Marshfield DoorSystems, Inc. (www.marshfielddoors.com)
   3. VT Industries, Inc. (www.vtindustries.com)

2.02 MATERIALS

A. Flush Wood Doors: AWI Section 1300.
   1. Core type:
      a. Solid, fire rated: Mineral.
      b. Solid, non-rated: PC - Bonded Particle Core.
   2. Number of plies: 3.
   3. Facings: High pressure plastic laminate, NEMA LD-3, Grade HGS, **Wilson Art Premium Laminate – Warehouse Oak #7969K-12**, Soft Grain Finish.
   4. Glazing beads: Solid wood.

2.03 FABRICATION

A. Fabricate doors in accordance with AWI Section 1300.

B. Prefitting: Factory fit doors to frames.

C. Premachining: Factory machine doors to receive hardware specified in Section 08 7100.

PART 3 – EXECUTION

3.01 PREPARATION

A. Condition doors to average humidity that will be encountered after installation.

3.02 INSTALLATION

A. Install doors in accordance with AWI Section 1700.

B. Install doors plumb and level.

C. If field cutting for height is necessary, cut bottom edge only, 3/4 inch maximum.

D. Apply sealer to field cut surfaces.

E. Install door hardware in accordance with Section 08 7100.

F. Install glass as specified in Section 08 8000.

G. Installation Tolerances; Warp: Maximum 1/4 inch in any 3'-0" x 7'-0" portion of door, measured with taut string or straight edge on concave face of door.

END OF SECTION

SECTION 08 1743
FRP DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUBMITTALS

A. General: Comply with Section 01 3300 - Submittal Procedures.

B. Product Technical Data Including:

1. Acknowledgment that products submitted meet requirements of standards referenced.
2. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
3. Manufacturer's installation instructions.
4. Schedule of doors and frames indicating the specific reference numbers used on the owner's project documents, noting door type, frame type, size, handing and applicable hardware.
5. Details of core and edge construction. including factory construction specifications.
6. Certification of manufacturer's qualifications.

C. Submittal Drawings for Customer Approval Shall be Submitted Prior to Manufacture and Will Include the Following Information and Formatting:

1. Summary door schedule indicating the specific reference numbers as used on owner's drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
2. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.
3. Drawing showing dimensional location of each hardware item and size of each door.
4. Individual part drawing and specifications for each hardware item and FRP part or product.
5. Construction and mounting detail for each frame type.

D. Samples: Provide one complete manufactured door sample which represents all aspects of the typical manufacturing process, including molded in gelcoat color and face plate construction. One edge should expose the interior of the door depicting the unique u-shaped continuous piece stile and rail, hardware reinforcement and core material.

E. Operation and Maintenance Manual

1. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use condition.
2. Include one set of final as built drawings with the same requirements as mentioned in Section C above.
3. Include certificate of warranty for door and frame listing specific door registration numbers.
4. Include hardware data sheets and hardware manufacturer's warranties.

1.02 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of 5 years documented experience and with a record of successful in-service performance for the applications as required for this project.
2. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.

3. Source limitations: Obtain fiberglass reinforced plastic doors and resin transfer molded fiberglass frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames. This ensures complete uniformity of physical properties and consistency in the resin chemistry tailored for this application.
4. Source limitations: Hardware and accessories for all FRP doors as specified in Section 08 7100 - Door Hardware shall be provided and installed by the fiberglass door and frame manufacturer.
5. Source Limitations: Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related Section 08 8000 - Glazing

1.03 DELIVERY, STORAGE, AND HANDLING

A. Each door and frame shall be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.
B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
C. Handling: Protect materials and finish from damage during handling and installation.

1.03 WARRANTY

A. All fiberglass doors and frames have a lifetime guarantee against failure due to corrosion. Additionally, fiberglass doors and fiberglass frames are guaranteed for ten years against failure due to materials and workmanship, including warp, separation or delamination, and expansion of the core.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Edgewater Door. (phone: 920-886-1995 website: www.edgewaterdoor.com).
B. Substitutions may be considered provided manufacturer can comply with the specifications as written herein and said products are manufactured in the United States of America. Requests for substitution must be submitted in writing no less than 10 days prior to bid date. Substitution request to include a physical sample and written documentation that product will meet the specific manufacturing methods as indicated below.

2.02 FRP DOORS

A. Doors shall be made of fiberglass reinforced plastic (FRP) using Class 1 premium resin with no fillers that is specifically tailored to resist chemicals and contaminants typically found in environment for which these specifications are written. Doors shall be 1 ¾ inch thick and of flush construction, having no seams or cracks. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer. Components obtained through various outside sources for plant assembly will not be accepted.
B. Door Plates shall be 0.125-inch-thick minimum, molded in one continuous piece, starting with 25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving. Each layer shall be individually laminated with resin as mentioned above. Door plate weight shall not be less than 0.97 lbs per

square foot at a ratio of 30/70 glass to resin. Plate alone to withstand Large Missile Impact per FBC TAS 201. Face plates manufactured using the pultrusion process does not allow for a smooth molded gelcoat finish, the use of woven roving for adequate plate thickness, strength and weight, or the appropriate glass to resin ratio and will not meet the quality standards of this project.

C. Stiles and Rails shall be constructed starting from the outside toward the inside, with a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints and disparate materials used to form the one-piece stile and rail.

D. Core material shall be polyurethane.

E. Internal Reinforcement shall be #2 SPF of sufficient amount to adequately support required hardware and function of same.

F. Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat results in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

G. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Fiberglass retainers, which hold the glazing in place, shall be resin transfer molded with a profile that drains away from glazing. The window retainer must match the color and finish of the door plates with 25 mil of resin-rich gelcoat integrally molded in at time of manufacture. Mechanical fasteners shall not be used to attach retainers. Glass, as specified herein, shall be furnished and installed by door and frame manufacturer. In order to maintain uniform appearance, product longevity and the corrosion resistance this application requires, window retainers fabricated from Metal, PVC or Vinyl will not be accepted.

H. Louver openings shall be completely sealed so that the interior of the door is not exposed to the environment. Louvers are to be solid fiberglass “V” Vanes and shall match the color and finish of the door plates.

I. Transoms shall be identical to the doors in finish, construction, materials, thickness and reinforcement.

2.03 FRP FRAMES

A. Frames (rated and non-rated) shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames will not be accepted.

B. Finish of frame shall be identical to the door with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture. To achieve optimum surface characteristics, the gelcoat shall be

cured within a temperature range of 120ºF. to 170ºF creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat result in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

C. Jamb/Header connection shall be mitered for tight fit.

D. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall be a dense matrix of cloth glass fibers and premium resin with a minimum hinge screw holding value of 1000 lbs per screw. All reinforcing materials shall be completely encapsulated. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.

E. Mortises for hardware shall be accurately machined by CNC to hold dimensions to +/- 0.010 inch in all three axis.

F. Hinge pockets shall be accurately machined by CNC to facilitate heavy duty hinges at all hinge locations, using shims when standard weight hinges are used.

2.04 HARDWARE

A. See Section 08 7100 - Door Hardware.

B. The special nature of this material requires that all related hardware as specified must be furnished and installed by the door frame manufacturer to maintain product quality and function as well as to ensure sufficient support/reinforcement, precision tooling and proper sealing methods are provided.

PART 3 - EXECUTION

3.01 INSTALLATION CONDITIONS

A. Verification of Conditions (Post-Applied)

1. Verify openings are correctly prepared to receive doors and frames.
2. Verify openings are correct size and depth in accordance with submittal drawings.

B. Installer’s Examination

1. Door installer shall examine conditions under which construction activities of this section are to be performed and submit a written report to general contractor if conditions are unacceptable.
2. Contractor shall submit two copies of the installer’s report to the architect within 24 hours of receipt.
3. Installer shall not proceed with installation until all unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Doors shall be delivered at job site individually crated. Each crate to be clearly marked with the specific opening information for quick and easy identification.

B. All single doors to be shipped completely assembled in the frame with hardware installed. Double doors to be pre-hung at the factory to ensure a proper fit and that hardware functions properly, then disassembled for shipping purposes.

C. Install door opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
D. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
E. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.

3.03 ADJUSTING

A. Adjust doors in accordance with the door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instruction.

3.04 CLEANING

A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

3.05 PROTECTION OF INSTALLED PRODUCTS

A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Provide sizes, types, finishes, scheduled locations, & details of adjoining work.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Babcock-Davis Hatchways, Inc. (www.babcockdavis.com)
   2. J.L. Industries. (www.jlindustries.com)
   3. Karp Associates, Inc. (www.karpinc.com)
   4. Milcor. (www.milcorinc.com)
   5. Nystrom Building Products, Inc. (www.nystrom.com)

2.02 MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

2.03 FABRICATION

A. Fabricate door frame of stainless steel sheet:
   1. Doors 12 x 12 inches and smaller: Minimum 18 gage.
   2. Doors over 12 x 12 inches: Minimum 16 gage.
   3. Fabricate frames with flange type to suit installation conditions.
B. Fabricate door panels of minimum 14 gage stainless steel sheet.
C. Weld, fill, and grind joints to flush and square appearance.
D. Hardware:
   1. Continuous steel hinges, 175 degree opening.
   2. Screwdriver operated cam latch.

2.04 FINISHES

A. Doors and Frames: No. 4, satin directional.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's written instructions and recommendations.
B. Install plumb and level in openings. Secure rigidly in place.
C. Position units where indicated or where required to provide convenient access to concealed work requiring maintenance.

END OF SECTION

SECTION 08 4113
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Indicate system dimensions, framed opening requirements and tolerances, trim, sealers, and accessories.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. EFCO Corporation. (www.efcocorp.com)
   2. Kawneer Co., Inc. (www.kawneer.com)
   3. Tubelite, Inc. (www.tubeliteinc.com)
   4. Vistawall Architectural Products. (www.vistawallinternational.com)
   5. YKK AP America, Inc. (www.ykkap.com)

B. Entrances and Storefronts; Basis-of-design: YKK YES 45 TU by YKK AP America, Inc.

C. Entrance Doors; Basis-of-design: YKK 35XT by YKK AP America, Inc.

2.02 MATERIALS

A. Aluminum:
   1. Extrusions: ASTM B 221, 6063-T5 alloy and temper.
   2. Sheet: ASTM B 209, alloy and temper best suited to application.

2.03 COMPONENTS

A. Entrances Doors: Medium stile configuration with nominal 3-1/2-inch vertical stiles, 6-1/2 inch top rail, and 10 inch bottom rail.

B. Storefront: Flush glazing system designed to receive 1-inch glass by means of elastomeric gaskets; 2 inch face width x 4-1/2 inch depth, center glass application.

C. Door Hardware: Specified in Section 08 7100. Door hardware supplied by aluminum-framed entrance manufacturer is NOT acceptable.

2.04 ACCESSORIES

A. Fasteners:
   1. Series 300 stainless steel for wet locations and exposed fasteners.
   2. Stainless or fluoropolymer coated steel for other locations.

B. Joint Sealers: Specified in Section 07 9200.

C. Glass and Glazing Accessories: Specified in Section 08 8000.

D. Weatherstripping: Replaceable, resilient bulb type.

2.05 FABRICATION

A. Fabricate with minimal clearances and shim spaces around perimeter.

B. Accurately fit and secure joints and intersections. Make joints flush, hairline, and weathertight.

C. Fabricate in largest practical units.

D. Conceal fasteners and attachments from view.

E. Fabricate aluminum components with integral low conductance thermal barrier located between exterior and interior exposed components that eliminates metal-to-metal contact.

F. Doors:

1. Mechanically fastened and welded corner construction.
2. Fabricate stiles and rails of minimum 0.125 inch thick extrusions and glass stops from minimum 0.050 inch thick extrusions.
3. Provide weatherstripping at door head, jambs, meeting stiles, and sills.
4. Prepare with internal reinforcements for door hardware.

2.06 FINISHES

A. Aluminum: AAMA 611, Architectural Class I anodized to 0.0007 inch minimum thickness, Dark Bronze.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor to supporting construction.

D. Set thresholds and sill members exposed to weather in mastic and secure.

E. Install hardware using templates provided by manufacturer.

F. Install glass and accessories in accordance with Section 08 8000.

G. Installation Tolerances:

1. Maximum variation from plumb or level: 1/8 inch in 3 feet or 1/4 inch in any 10 feet, whichever is less.
2. Maximum misalignment of members abutting end to end: 1/32 inch.
3. Sealant space between framing members and adjacent construction: 1/4 inch plus or minus 1/16 inch.

3.02 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust doors to operate with maximum opening forces in accordance with applicable accessibility code.

C. Touch up minor scratches and abrasions to match original finish.

D. Adjust weatherstripping to contact appropriate surfaces and form weather seal.

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes aluminum windows for exterior locations.

B. Related Requirements:

1. Section 08 4113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
2. Section 08 8000 “Glazing”.

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.

1. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
2. Product Data: Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
3. Samples: For aluminum windows and components required, showing full range of color variations for finishes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. EFCO Corporation. (www.efcocorp.com)
2. Kawneer Co., Inc. (www.kawneer.com)
3. Tubelite, Inc. (www.tubeliteinc.com)
4. Vistawall Architectural Products. (www.vistawall.com)
5. YKK AP America, Inc. (www.ykkap.com)

B. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Fixed.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

E. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.02 WINDOW PERFORMANCE REQUIREMENTS

A. Product 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. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: AW.
   2. Minimum Performance Grade: 70.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.38 Btu/sq. ft. x h x deg F for fixed sashes, 0.45 Btu/sq. ft. x h x deg F for operable sashes.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

G. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

H. Outside-Inside Transmission Class (OITC): Rated for not less than 26 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

I. Windborne-Debris-Impact Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

2.03 ACCESSORIES

A. Dividers (False Muntins): Provide extruded-aluminum divider grilles in designs indicated for each sash lite.
   1. Type: Permanently located at exterior lite, between insulating-glass lites, and at interior lite.
   2. Pattern: As indicated on Drawings.
   3. Profile: As selected by Architect from manufacturer's full range.

B. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

C. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

F. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.04 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (Three-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Match Storefront color selection exactly, (Dark Bronze) provide custom color if needed. See Section 08 4113 Aluminum-Framed Entrances and Storefronts.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
   2. Air-Infiltration Testing:
      a. Test Pressure: That required to determine compliance with AAMA/ WDMA/ CSA 101/I.S.2/A440 performance class indicated.
      b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/ CSA 101/ I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
   3. Water-Resistance Testing:
      a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/ WDMA/ CSA 101/I.S.2/A440 performance grade indicated.
      b. Allowable Water Infiltration: No water penetration.
   4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
   5. Test Reports: Prepared according to AAMA 502.
C. Windows will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.
B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 5123
HOLLOW METAL WINDOWS & FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes hollow metal windows and frames for interior locations.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 07 9200 - Joint Sealants.
3. Section 08 8000 - Glazing.
4. Section 09 9000 - Painting and Coating.

1.02 DESIGN REQUIREMENTS

A. Drawings indicate sizes, locations, and general details of steel windows construction and installation.

B. Window Sections: Hot-dipped galvanized and primed ready to receive paint finish.

C. Performance Requirements: Frames shall provide for glazing expansion and edge engagement as specified in Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

B. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

C. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage through Installed Windows and Doors.

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, including plans, elevations, opening identification symbols, sizes, typical unit elevations and enlarged elevations indicating full or half scale detail sections of products being supplied and typical installation details. Indicate anchor locations, as well as any other components not included in manufacturer’s standard data. Indicate type of glazing, screening, and applied finish.

B. Product Data: Submit manufacturer’s specifications, recommendations and standard details for steel windows units, including independent laboratory certified tests as necessary to demonstrate compliance with specified requirements.

C. Material Samples: Submit a window Sample fabricated of the materials, fasteners, glazing, panning, and sealing system identical to the system specified.

1.05 QUALITY ASSURANCE

A. Windows shall conform to requirements of Steel Window Institute (SWI) - Steel Window Specifications.

B. Mock-ups: Provide a mock-up of one typical window unit for review by the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's packaging to protect windows during shipping and storage.

B. Store windows indoors in clean well-ventilated area and stack vertically on edge with wood or plastic shims between components to provide water drainage and air circulation.

1.07 WARRANTY

A. Manufacturer shall provide a five year material warranty.

B. Installer shall provide a two year installation warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide one of the following, or equal:

1. Torrance Steel Windows: Jefferson Series 1900.
2. Coast to Coast Manufacturer: Series 150.
3. Hope's Windows and Doors: Landmark175 Series.
4. Approved Equal.

2.02 FIXED AND OPERABLE STEEL WINDOWS

A. Windows shall conform to requirements of SWI - Steel Window Institute. Windows shall be fabricated for inside glazing, and shall be factory-glazed.

B. Fixed steel windows shall be of types and sizes indicated on the Drawings and specified, and shall include operating hardware, anchors, and miscellaneous items as specified or required.

C. Window frames, horizontal and vertical sash members and muntin bars shall be of 7/8 inch by 1 1/2-inch steel tees for 1/4 inch single glazing. Horizontal muntin bars shall be spaced at 4 inches maximum clear and vertical muntin bars at 12 inches on center, unless otherwise indicated.

D. When assembled, ventilators and sash shall be square and true, with a uniform margin around frames. When fastened in position with locking hardware, windows shall be weathertight.

E. Air Infiltration: The total air infiltration shall not exceed 0.06 cfm per square foot of fixed wall area or 0.37 cfm per linear foot of vent crack length.

F. Water Penetration: When tested in accordance with ASTM E331, there shall be no water leakage at a static pressure of 8 psf.

G. Structural Performance: When tested in accordance with ASTM E330, there shall be no failure of locks, hinges or other parts, at a positive pressure and a negative pressure of 60 psf (150 percent design load).

2.03 FINISH

A. Clean surfaces to remove loose materials, dust, dirt and grease, or other substances detrimental to adhesion of finish coats.

B. Factory prime steel surfaces to receive field-applied paint finish. Coordinate with requirements in Section 09 9000 - Painting and Coating.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install windows in prepared openings. Install mastic to provide weathertight seal wherever metal to metal joints occur within the window system. Provide screws, shield, plugs, and other fasteners required for installation. Seal screw heads and unused fixing holes around entire perimeter. Provide mastic on the full

length of mullions and install. Windows shall be properly aligned, securely anchored, and properly adjusted with hardware installed before glazing.

B. Windows and operators shall be installed plumb, square, level, and true within their respective openings. Adjoining units of windows or assembly of windows shall be installed in a uniform plane, with rails, muntins, and members uniformly joined and accurately aligned.

C. Upon completion of glazing, examine windows and operating devices for proper installation and operation. Operate vents and hardware and adjust to ensure proper installation and operation. Adjust as required.

3.02 FIELD QUALITY CONTROL

A. Conduct on-site tests with window manufacturer's representative, Project Inspector, and Architect present. Architect will select units to be tested on the day of the testing. Provide access to windows on each level and façade of the building. Testing shall be performed by a qualified independent testing agency selected by the Architect.

B. Ten percent of installed windows shall be selected for water testing. If one or more windows fail, an additional ten percent of windows (not including the ones previously tested) shall be selected by the Architect for further testing. Selection of an additional ten percent of windows and retesting will be performed until no leaks occur in any of the test samples.

C. Water-resistance test: Conduct according to requirements of ASTM E 1105. No water leakage is permitted. Windows shall be field tested at 8 pounds per square foot field test pressure differential.

D. Air-infiltration test: Conduct according to requirements of ASTM E 783-02. Allowable infiltration shall not exceed 1.5 times the amount required. Windows shall be tested at 6.24 PSF (pounds per square foot) field test pressure differential.

E. Field Test report shall be submitted to the Owner, Contractor and Architect. Field Test report must include the following:

1. Name of the testing agency and testing agency’s credentials.
2. Date of test.
3. Standards complied with during testing.
4. Number and locations of specimens tested.
5. Thorough analysis of test result indicating passing or failing of specimens at pressures specified.
6 Photos illustrating conditions of failed compliance at pressures required.

3.03 CLEAN UP

A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Schedule hardware by door type and location; show door size, hand, thickness, edge bevel, hardware components and quantities, keying, and finishes.
   2. Product Data: Manufacturer's descriptive data for each component.
   3. Warranty: Sample warranty form.

B. Closeout Submittals:
   1. Copy of approved hardware schedule.
   2. Keying list.
   3. Keys; tag with mark corresponding to keying schedule.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this section.

B. Provide hardware labeled by recognized independent testing laboratory and meeting requirements of NFPA 80 for fire-rated doors.

C. Provide smoke gasketing at fire-rated doors in accordance with NFPA 105.

D. Accessibility Standards: Hardware shall be in conformance with 2012 Texas Accessibility Standards (TAS), Elimination of Architectural Barriers, Texas Government Code, Chapter 469.
   1. Door Closers: The sweep period of the closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch measured to the leading edge of the door.
   2. Door Opening Force: The maximum force for pushing or pulling open a door shall be as follows:
      a. Fire doors shall have the minimum opening force allowable by the appropriate administrative authority.
      b. Exterior hinged doors: (Reserved).
      c. Interior hinged doors: 5 lbf.
      d. Sliding or folding doors: 5 lbf.
      e. These forces do not apply to the force required to retract latch bolts or disengage other devices that may hold the door in a closed position.

E. Pre-installation Conference:
   1. Convene at site prior to ordering permanent cylinders for project.
   2. Attendance: Owner, Construction Manager, and hardware supplier.
   3. Review, discuss, and finalize Owner’s keying requirements.

1.03 DELIVERY, STORAGE AND HANDLING

A. Pack hardware items separately, with fasteners, installation instructions, and templates.

B. Mark containers with item number corresponding to hardware schedule.

1.04 WARRANTIES

A. Locksets: Three-year limited factory warranty against defects in material and workmanship.

B. Door Closers: Ten-year limited factory warranty against defects in workmanship and operation.

C. Exit Devices: Three-year limited factory warranty against defects in workmanship and operation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Butt Hinges:

1. Architectural Builders Hardware. (www.abhmfg.com)
2. Bommer Industries, Inc. (www.bommer.com)
3. Hager Companies. (www.hagerco.com)
4. McKinney Products Co. (www.mckinneyhinge.com)
5. Stanley Hardware. (www.stanleyworks.com)

B. Manufacturers - Locksets, Latchsets, Deadbolts, and Cylinders:

1. Preferred Manufacturer:
   a. Schlage Lock Co. (www.schlage.com)
2. Acceptable Manufacturers:
   a. Best Access Systems. (www.bestaccess.com)
   b. Corbin Russwin Architectural Hardware. (www.corbin-russwin.com)
   c. Sargent Mfg. (www.sargentlock.com)
   e. Yale Security, Inc. (www.yalelocks.com)

C. Manufacturers - Closers:

1. Preferred Manufacturers:
   a. LCN Closers. (www.lcnclosers.com)
   b. Norton. (www.nortondoorcontrols.com)
   c. Sargent Mfg. (www.sargentlock.com)
2. Acceptable Manufacturers:
   a. Corbin Russwin Architectural Hardware. (www.corbin-russwin.com)
   b. Yale Security, Inc. (www.yalelocks.com)

D. Acceptable Manufacturers - Exit Devices:

1. Corbin Russwin Architectural Hardware. (www.corbin-russwin.com)
2. Sargent Mfg. (www.sargentlock.com)
3. Von Duprin. (www.vonduprin.com)
4. Yale Security, Inc. (www.yalelocks.com)

E. Acceptable Manufacturers - Door Seals:

1. Hager Companies. (www.hagerco.com)
2. National Guard Products, Inc. (www.ngpinc.com)
3. Pemko Manufacturing Co. (www.pemko.com)
4. Reese Enterprises, Inc. (www.reeseusa.com)

2.02 MANUFACTURED UNITS

A. Butt and Continuous Hinges:

1. Description: ANSI/BHMA A156.1, full mortise type, five knuckle, non-rising pin, hole in bottom tip for pin removal.

2. Acceptable manufacturers and respective catalog numbers:

ABH	Bommer	Hager	McKinney	Stanley
A110HD	BB5000	BB1279	TB2714	FBB179
A111HD	BB5004	BB1168	T4B3786	FBB168
A130HD	BB5002	BB1191	TB2314	FBB191
A210HD	BB5006	BB1199	T4B3386	FBB199

3. Furnish hinges in size, weight, and finishes listed in hardware set. W here scheduled as BB, provide ball bearing hinges. Oil-impregnated porous metal bearing hinges are not acceptable.

B. Locksets, Latchsets, and Deadbolts:

1. Locksets and latchsets Type: ANSI/BHMA A156.13, Grade 1, mortise, lever handles. Acceptable manufacturers and respective catalog numbers:

Schlage (Preferred)	Best	Corbin-Russwin	Yale
L9010	35H-0-N	ML2010	8801FL
L9466	35H-7-C	ML2022	8860-2FL
L9440	35H-7-LF	ML2030	8802FL
L9050	35H-7-E	ML2051	8807FL
L9070	35H-7-J	ML2055	8808FL
L9456	35H-7-FW	ML2065	8822FL
L9080	35H-7-EW	ML2057	8805FL
L9457	35H-7-IND	ML2072	8818-2FL

a. Provide mortise locks in functions as listed in hardware sets.

b. Locks and trim shall be from the same manufacturer.

2. Deadbolts: ANSI/BHMA A156.5, cylindrical type with 1 inch bolt throw. Acceptable manufacturers and respective catalog numbers:

Schlage (Preferred)	Best	Corbin-Russwin	Yale
L463	48H-7-R	DL4017	313ST

3. Strike boxes: Steel.

C. Keying:

a. Construction key locks.

b. Master key locks in one set.

c. Key alike, cross key, or otherwise key as directed by Owner.

d. Provide two keys for each lock and 6 master keys for each master key system.

e. Inscribe keys with lock manufacturer.

D. Closers:

1. Description: ANSI/BHMA A156.4, overhead exposed, plastic cover, adjustable for door sizes 2 through 6.

2. Acceptable manufacturers and respective catalog numbers:

Exterior/Storefront Doors

*LCN	*Norton	*Sargent	Corbin Russwin	Yale
P4040-EDA	PR7500	351-P10	DC6210 x A3	PR4400

*Preferred Manufacturer

Interior Doors

*LCN	*Norton	*Sargent	Corbin Russwin	Yale
1460 FC	8501	1431	DC6200	3501
P1460-3077EDA	PR8501	1431 P10	DC6210 x A3	PR3501
P1460-62A	P8501 x 2018S	1431	DC6210 x A13	P3A P3501 x 290

*Preferred Manufacturer

3. Provide door closers from one manufacturer.

E. Exit Devices:

1. Description: ANSI/BHMA A156.3, Grade 1, push pad type.

2. Acceptable manufacturers and respective catalog numbers:

Corbin Russwin	Detex	Von Duprin	Yale
ED4200 x K957	4003	33A-NL-OP	7200 x 121NL
ED4200	4001	33A-EO	7200 x 500F
ED5200	1001	99-EO	7100 x 620F

3. Provide exit devices from one manufacturer.

4. Provide exit devices with stainless steel touch pads.

5. Provide and install exit devices with sex nuts and bolts.

F. Door Stops: Floor mounted, aluminum housing with resilient bumper.

G. Push and Pull Plates: 16 gage, beveled edges, 4 x 16 inches, secured with through bolts.

H. Door Pulls: 1" round profile, 10 inches center-to-center of mounting holes.

I. Kick Plates:

1. Type: 16 gage, beveled edges, secured with flathead countersunk screws.

2. Size: 10 inches high x door width less 2 inches.

J. Flush Bolts: Manual type, 12 inches long, with dustproof strike.

K. Weatherstripping:

1. Head and jambs: 130NA and 198NA.

2. Sill: 200NA.

3. Astragals: 125NA.

L. Thresholds: 896 and 4884.

M. Rain Drip: 16A.

N. Smoke Seals: 5050C, perimeter; 9500 x 2525B door edge.

O. Key Control System:
   1. Cabinet: Sheet steel with baked enamel finish, piano hinged door, and lock keyed to building system.
   2. Capacity: 150 percent of locks required for project.
   3. Horizontal metal strips for key hook labeling with plastic strip cover over paper labels.

2.03 FINISHES

A. Finishes: To ANSI/BHMA A156.18.
B. Door Closers: Finish No. 690, dark statuary bronze enamel.
C. Hinges at Fire-rated Doors: Finish No. 640, satin bronze plated, oxidized and oil rubbed.
D. Thresholds and Door Seal Housings: Bronze anodized.
E. Other: Finish No. 613, satin bronze, oxidized and oil rubbed.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with approved hardware schedule and manufacturer's written instructions and recommendations.
B. Install mortise items flush with adjacent surfaces.
C. Install locksets, closers, and trim after finish painting.
D. Set thresholds in mastic and secure.
E. Mount closers so that closers and closer arms are not visible on corridor or public side of doors nor on exterior of building.
F. Mounting Heights - Finished Floor to Center Line of:
   1. Locksets: 38 inches.
   2. Push and pull plates: 42 inches.
   3. Dead locks: 48 inches.
   4. Push pad exit devices: 42 inches.
   5. Top hinge: Maximum 10 inches from frame head.
   6. Bottom hinge: Maximum 12-1/2 inches from floor.
   7. Intermediate hinges: Equally spaced.
G. Set key cabinet in place, place keys in cabinets, label and index.

3.02 PROTECTION

A. Remove or protect hardware until painting is completed.

3.03 ADJUSTING

A. Test and adjust hardware for quiet, smooth operation, free from binding and rattling.
B. Adjust doors to operate with maximum opening forces in accordance with applicable accessibility code.

3.04 SCHEDULE

A. The following sets cover type of hardware required -- hardware supplier shall make his own take off. In the event of omissions in the schedule, furnish hardware of the kind, quantity, and quality scheduled for similar locations. Hardware for a complete installation is required, whether specifically mentioned hereinafter or not.

B. Designations in hardware schedule are taken from the following manufacturers:

Arch. Builders Hardware	(ABH)	Norton	(NO)
Best	(B)	Schlage	(SCH)
Hager	(H)	Trimco	(T)
National Guard	(N)	Von Duprin	(V)

C. Hardware Set No. 1: [pr. aluminum entrance – Door 101A]

2 continuous gear hinge	A110HDC/A260HDC 83”	(ABH)
1 exit device	33A-NL-OP	(V)
1 exit device	33A-EO	(V)
1 rim cylinder	As required.	
1 mortise cylinder	As required.	
1 removable mullion	KR1654 x M54	(V)
2 closers	PR7500	(NO)
2 pulls	922P	(H)
2 overhead stops	1023	(ABH)
1 overhead rain drip	16A	(N)
2 bottom rail	weatherstripping 200	(N)
1 threshold	896V	(N)

All wiring and connections by division 26.

Operational description: Immediate egress always allowed. Connected to building's fire & security system.

D. Hardware Set No. 2: [sgl. aluminum entrance – Doors 104A & 117A]

1 continuous gear hinge	A110HDC/A260HDC 83”	(ABH)
1 exit device	33A-NL-OP	(V)
1 rim cylinder	As required.	
1 mortise cylinder	As required.	
1 closer	PR7500	(NO)
1 pull	922P	(H)
1 overhead stop	1023	(ABH)
1 overhead rain drip	16A	(N)
1 bottom rail	weatherstripping 200	(N)
1 threshold	896V	(N)

All wiring and connections by division 26.

Operational description: Immediate egress always allowed. Connected to building's fire & security system.

E. Hardware Set No. 3: [sgl. passage w/deadlatch – Door 101B & 102B]

3 hinges	1279 4-1/2 x 4-1/2	(H)
1 deadbolt lock	B660 613	(SCH)
1 door pull	1017-3	(T)
1 push plate	1001-3	(T)
1 closer	8501	(NO)

2 kick plate	K0050	(T)
3 silencers	307D	(H)
1 overhead stop/holder	7010	(ABH)

F. Hardware Set No. 4: [sgl. privacy w/occupancy indicator – Doors 102A & 118A]

3 hinges	BB1279 4-1/2 x 4-1/2	(H)
1 privacy	L9486 HD 17A	(SCH)
1 permanent core	80-037 By Owner	(SCH)
1 closer	8501	(NO)
1 overhead stop	9024	(ABH)
1 kick plate	K0050	(T)
3 silencers	307D	(H)

G. Hardware Set No. 5: [passage w/floor stop – Doors 104C, 107A, 107B, 108A, 108B, 109A, 109B, 110A, 110B, 119A, 123A, 124A, 124B, 127A & 128A]

3 hinges	BB1279 4-1/2 x 4-1/2	(H)
1 latchset	ND10S	(SCH)
1 closer	8501	(NO)
3 silencers	307D	(H)
1 kick plate	K0050	(T)
1 floor stop	1214	(T)

H. Hardware Set No. 6: [passage w/overhead stop – Doors 114A, 129A & 130A]

3 hinges	BB1279 4-1/2 x 4-1/2	(H)
1 latchset	ND10S	(SCH)
1 closer	8501	(NO)
3 silencers	307D	(H)
1 kick plate	K0050	(T)
1 overhead stop	9024	(ABH)

I. Hardware Set No. 7: [interior office – Doors 120A, 121A & 122A]

3 hinges	BB1279 4-1/2 x 4-1/2	(H)
1 lockset	ND50	(SCH)
1 permanent core	80-037 By Owner	(SCH)
3 silencers	307D	(H)
1 floor stop	1214	(T)

J. Hardware Set No. 8: [sgl. swinging w/deadlatch – Door 115A]

1 double acting head/floor pivot hinges	1-1/2 x 12FH	(H)
1 deadbolt lock	B660 613	(SCH)
1 door pull	1017-3	(T)
1 push plate	1001-3	(T)

1 closer	8501	(NO)
2 kick plate	K0050	(T)
1 overhead stop/holder	7010	(ABH)

K. Hardware Set No. 9: [sgl. storeroom w/overhead stop – Doors 111A & 111B]

3 hinges	1279 4-1/2 x 4-1/2	(H)
1 lockset	L9080	(SCH)
1 overhead stop	9026	(ABH)
1 kick plate	K0050	(T)
3 silencers	307D	(H)

L. Hardware Set No. 9: [sgl. sliding door – Door 104B]

1 sliding door hardware	HBP200A 4’	(Pemko)
2 Flush Pull (mount back to back)	RM782	(Rockwood)

M. Hardware Set No. 10: [sgl. ext. fiberglass mechanical rooms – Doors 131A, 133A & 133B]

3 hinges	BB1191 4-1/2 x 4-1/2 NRP	(H)
1 deadbolt lock	L464	(SCH)
1 cylinder pull	1822-2	(T)
1 overhead stop	9024	(ABH)
1 overhead rain drip	16	(N)
1 set head & jamb weatherstripping	130	(N)
1 bottom rail weatherstripping	200	(N)
1 threshold	896	(N)

N. Hardware Set No. 11: [pr. ext. HM electrical room – Door 132A]

6 hinges	BB1279 4-1/2 x 4-1/2	(H)
1 mortise deadlock	L463 HD	(SCH)
1 permanent core	80-037 By Owner	(SCH)
1 cylinder pull	1822-2	(T)
2 flush bolts	3922	(T)
1 dustproof strike	3910	(T)
6 silencers	307D	(H)
2 overhead stops	9026	(ABH)
1 overhead rain drip	16	(N)
1 set head & jamb weatherstripping	130	(N)
1 bottom rail weatherstripping	200	(N)
1 threshold	897N	(N)

O. Hardware Set No. 16:

1 key cabinet	1203 by Lund.

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Descriptive data and performance attributes for insulated glass.
   2. Samples: 12 x 12 inch glass sample, mirror glass.
   3. Warranty: Sample warranty form.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Provide safety glass for locations subject to human impact as required by Building Code.
   2. Safety glass: Tested and labeled to CPSC 16 CFR 1201.
B. Perform Work in accordance with GANA Glazing Manual and GANA Laminated Glass Design Guide.

1.03 PROJECT CONDITIONS

A. Perform glazing when ambient temperature is above 40 degrees F.
B. Perform glazing on dry surfaces.

1.04 WARRANTIES

A. Insulating Glass Units: Provide manufacturer's 10-year warranty against material obstruction of vision through unit due to:
   1. Intrusion of dust or moisture.
   2. Internal condensation.
   3. Film formation on internal glass surfaces caused by failure of hermetic seal except failure caused in whole or in part by breakage or fracturing of any portion of glass surface.
B. Laminated Glass Units: Provide manufacturer's 5 year warranty against manufacturing defects resulting in edge separation, delamination, or material obstruction of vision through glass surface.
C. Mirrors: Provide manufacturer's 10-year warranty against silver spoilage resulting from manufacturing defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Glass:
   1. Oldcastle Building Envelope. (www.oldcastlebe.com)
   2. Pilkington Architectural. (www.pilkington.com)
   3. Vitro Architectural Glass. www.vitroglazings.com
   4. Viracon, Inc. www.viracon.com

2.02 MATERIALS - GLASS

A. Clear Glass: ASTM C 1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
B. Clear Tempered Glass: ASTM C 1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind FT fully tempered.
C. Mirror Glass: ASTM C 1036, Type I transparent flat, Class 1 clear, Quality q1 mirror select.

2.03 ACCESSORIES

A. Setting Blocks: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone; 80 to 90 Shore A durometer hardness.

B. Spacers: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone; 50 to 60 Shore A durometer hardness.

C. Glazing Gaskets:

1. Dense compression gaskets: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone or thermoplastic polyolefin rubber, molded or extruded shape to fit glazing channel retaining slot; black color.
2. Soft compression gaskets: ASTM C 509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal; black color.

D. Glazing Sealant: ASTM C 920, Type S, Grade NS, Class 25; single component silicone, low modulus, non sag, color to be selected from manufacturer's full color range.

E. Sealant Backing: ASTM C 1330, Type O, size and density to control glazing sealant depth and produce optimum glazing sealant performance.

F. Primer: As recommended by glazing sealant manufacturer.

G. Mirror Adhesive: Adhesive setting compound, produced specifically for setting mirrors by spot application method.

H. Laminating Film: Polyvinyl butyral sheet, minimum 90-mil thick, clear.

2.04 FABRICATION

A. Tempered Glass:

1. Comply with ASTM C 1048.
2. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.

B. Sealed Insulating Glass; Basis-of-design: **Solarban 90** “Solarbronze” Solar Control Low-E Glass by Vitro Glass.

1. Comply with ASTM E 2190.
2. Fabricate spacer bar frame of tubular aluminum filled with desiccant. Finish of aluminum spacer bar frame shall be clear anodized.
3. Bond spacer bar frame to glass panes with twin primary seals.
4. Fill space outside frame to glass edge with elastomeric sealant.
5. Insulating glass units shall meet or exceed: SHGC of 0.32 and have a U-value of 1.50 or better.

C. Laminated Glass:

1. Comply with ASTM C1172 and ANSI Z97.1.
2. Laminate glass with laminating film by manufacturer's standard heat and pressure process.
3. Cut glass to required size at factory.
4. Discard glass with voids, delamination, or entrapped dirt or foreign matter.

D. Low-E Coated Glass: Apply low-emissivity coating to No. 2 glass surface.

E. Glass Identification:

1. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.

2. Etch manufacturer's label on each light of tempered glass.

F. Mirror Glass:

1. Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
2. Arise and polish edges.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean glazing rabbets; remove loose and foreign matter.

B. Remove protective coatings on metal surfaces.

C. Clean glass just prior to installation.

3.02 INSTALLATION - GENERAL

A. Install glass in accordance with glass manufacturer's written instructions and recommendations.

B. Maintain manufacturer's recommended edge and face clearances between glass and frame members.

3.03 INSTALLATION - GASKET GLAZING METHOD

A. Fabricate gaskets to fit openings; allow for stretching of gaskets during installation.

B. Set soft compression gasket against fixed stop or frame with bonded miter cut joints at corners.

C. Set glass centered in openings on setting blocks.

D. Install removable stops and insert dense compression gaskets at corners, working toward centers of glass, compressing glass against soft compression gaskets to produce weathertight seal.

E. Seal joints in gaskets.

F. Allow gaskets to protrude past face of glazing stops.

3.04 INSTALLATION - MIRRORS

A. Apply mirror adhesive in accordance with manufacturer's instructions to cover maximum 25 percent of back of mirror. Set mirror and press against substrate to ensure adhesive bond.

B. Leave minimum 1/8 inch open ventilation space between mirror and substrate over 75 percent of mirror area. Do not seal off ventilation space at edges.

C. Place plumb and level without distortion.

3.05 PROTECTION

A. After installation, mark glass with an 'X' using removable plastic tape.

END OF SECTION

SECTION 08 9100
LOUVERS AND VENTS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit shop drawings: Include locations, elevations, sections, dimensions, materials, finishes, attachment, and relationship to adjacent construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers; Louvers:
   1. Airolite Company. (www.airolite.com)
   2. Construction Specialties, Inc. (www.c-sgroup.com)
   3. Industrial Louvers. (www.industriallouvers.com)
   4. Nystrom, Inc. (www.nystrom.com)
   5. Ruskin Co. (www.ruskin.com)

B. Acceptable Manufacturer; Brick Vents: Architectural Louvers (web site: www.archlouvers.com phone 888.568.8371). Equivalent products as manufactured by one of the following will be acceptable.
   1. Construction Specialties (www.c-sgroup.com)
   2. Hohmann & Barnard, Inc. (www.h-b.com)
   3. Wonder Metals (www.wondermetals.com)

2.02 MATERIALS

A. Galvanized Steel: ASTM A653/A653M, Structural Quality, hot dip galvanized, G90 coating class.

B. Screen: 16 x 18 mesh aluminum.

C. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T5.

2.03 COMPONENTS

A. Metal Louvers:
   1. Type: Fixed blade.
   2. Depth: 4 inches.
   3. Blade angle: 45 degrees.
   4. Blade profile: Drainable.
   5. Gutters: Drain gutters in each blade.
   6. Downspouts: In each jamb.

B. Brick Vents: Model EX by Architectural Louvers.
   1. Extruded-aluminum Louvers and Frames: 0.125-inch nominal thickness.
   2. Insect Screen: 18 x 14 mesh.
   3. Frame and Blade Nominal Thickness: 0.063 inch.
   4. Assemble by welding, incorporate weep holes, continuous drip at sill, load-bearing.

2.04 ACCESSORIES

A. Anchors: Stainless steel, type best suited to application.

2.05 FINISHES

A. Aluminum: AAMA 611, Architectural Class I anodized to 0.0007 inch minimum thickness, clear.

B. Galvanized Steel: AAMA 621, fluoropolymer coating containing minimum 70 percent PVDF resins, color to be selected from manufacturer's full color range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations.

B. Set plumb, level, and rigid, with flush hairline joints.

C. Anchor to supporting construction.

D. Prevent contact of aluminum and dissimilar metals by use of zinc rich paint, bituminous coating, or non absorptive gaskets.

E. Install screen on inside face.

F. Install blank out sheeting over unused portions of louver.

G. Install wiring between power supply and operator and between operator and controls.

3.02 ADJUSTING

A. Touch up minor scratches and abrasions in finish coat to match factory finish.

END OF SECTION

SECTION 09 2900
GYPSUM BOARD ASSEMBLIES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Illustrate panel product types, thicknesses, and locations; acoustical insulation; and accessories.

1.02 QUALITY ASSURANCE

A. Fire-resistance Ratings:
   1. Construct assemblies to achieve fire resistance ratings indicated on drawings, in accordance with UL design number.
   2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.

1.03 PROJECT CONDITIONS

A. Do not install gypsum board until building is substantially weathertight.
B. Maintain temperature in spaces in which work is being performed above 50 degrees F during and after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Gypsum Panels:
   1. CertainTeed Gypsum, Inc. (www.certainteed.com)
   2. GP Gypsum Corporation. (www.gp.com)
   3. National Gypsum Co. (www.nationalgypsum.com)
   4. Temple-Inland. (www.templeinland.com)
   5. United States Gypsum Co. (www.usg.com)
B. Acceptable Manufacturers - Cementitious Panels:
   1. James Hardie Building Products, Inc. (www.jameshardie.com)
   2. United States Gypsum Co. (www.usg.com)

2.02 MATERIALS - GYPSUM PANELS

A. Fire-resistant Gypsum Board: ASTM C1396, Type X; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge; apply to fire rated assemblies.
B. Fire-resistant, Water-resistant Gypsum Board: ASTM C1396, Type X; 48 inches wide x 5/8 inch thick, maximum practical length, water resistant; apply to fire rated walls to receive tile and walls at janitor closets.
C. Fire-resistant Gypsum Backing Board:
   1. ASTM C1178, Type X, fiberglass mat faced; 48 inches wide x 5/8 inch thick, maximum practical length, water resistant; apply to fire-rated walls to receive tile in showers.
   2. Mold resistance: Minimum 10, tested to ASTM D3273.

D. Abuse-resistant Gypsum Board: ASTM C 1278, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels. Provide Type X fire-rated, 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Product/manufacturer; Fiberock Brand VHI (Very High Impact) Abuse-resistant Panels; United States Gypsum Co.

2.03 MATERIALS - CEMENTITIOUS PANELS

A. Cementitious Panels: ANSI A 118.9, high density, cementitious with glass fiber reinforcing, 5/8 inch thick x 48 inches wide, maximum practical length, ends and edges square cut; apply to shower walls.

2.04 MATERIALS - METAL STUDS AND FRAMING

A. Steel: ASTM A 1003, Class G40 hot dip galvanized.
B. Studs: Non-load bearing rolled steel, channel shaped, punched for utility access.
C. Top and Bottom Runners: Same material and finish as studs, channel shaped.
D. Suspended Ceiling Framing:
   1. Runner channels: 1-1/2 inches deep, cold rolled, channel shaped, 16 gage core steel.
   2. Furring channels: Hat shaped, 7/8 inch deep, 25 gage core steel.
E. Resilient Channels: 1/2 inch deep x 2-1/2 inches wide, 25 gage core steel.
F. Wall Furring Channels: Hat shaped, 7/8 inch deep, minimum 25 gage core steel.

2.05 ACCESSORIES

A. Fasteners:
   1. Metal Studs and Framing: 3/8 inch long pan head screws.
   2. Gypsum Board: ASTM C 1002, Type S screws, minimum 5/8 inch penetration into framing.
B. Wire: ASTM A 641, galvanized steel.
   1. Hanger wire: 8 gage.
   2. Tie wire: 18 gage, soft annealed.
C. Acoustical Insulation: ASTM C 665, Type I, glass fiber composition, unfaced.
D. Adhesive: Type recommended by gypsum panel manufacturer.
E. Trim Accessories: ASTM C 1047.
   1. Material: Formed steel, minimum 26 gage core steel, hot dip galvanized finish, expanded flanges.
   2. Corner reinforcement: GA-216, Type CB-100 x 100.
   3. Casing: GA-216, Type LC.
   4. Control joint.
F. Acoustical Sealer: Specified in Section 07 9200.
G. Joint Treatment Materials: Reinforcing tape and joint compound; ASTM C 475.

PART 3 - EXECUTION

3.01 INSTALLATION OF PARTITION FRAMING

A. Install in accordance with ASTM C 754 and manufacturer's written instructions and recommendations.
B. Attach top and bottom runner channels at ends and 24 inches on center maximum.
C. Position studs vertically in runners, spaced maximum 16 inches on center unless indicated otherwise.

D. Locate studs maximum 2 inches from door frames and abutting construction.
E. Use double studs on both sides of openings in partitions.
F. Install horizontal runner as header above openings in partitions. Install studs from header to top runner.
G. Brace furred partitions with adjustable bracket located at mid height.
H. Provide wood or metal bracing in partitions to receive and support fixtures, trim, accessories and other applied items.
I. Brace ceiling height partitions to structure at 48 inches on center maximum.

3.02 INSTALLATION OF CEILING FRAMING

A. Install in accordance with ASTM C 754 and manufacturer's instructions.
B. Space hanger wires 48 inches on center maximum along runner channels and within 6 inches of ends of channels; secure to structure above.
C. Space runner channels 48 inches on center maximum and within 6 inches of abutting construction.
   1. Position channels for ceiling height; level and saddle tie along channels.
   2. Provide 1 inch clearance between channels and abutting construction.
   3. Overlap channel ends 12 inches at splices; secure each end with double loop tie wire.
D. Space furring channels 16 inches on center maximum, perpendicular to runners and within 6 inches of abutting construction.
   1. Provide 1 inch clearance between channels and abutting construction.
   2. Secure to runners with clips on alternate sides of runners; saddle tie if clips cannot be alternated.
   3. Overlap channel ends 8 inches at splices; secure each end with double loop tie wire.
E. Where openings interrupt furring or runner channels, install reinforcing to restore stability.

3.03 INSTALLATION OF GYPSUM PANELS

A. Install panels and accessories in accordance with ASTM C 754, GA-216, and manufacturer's instructions.
B. Accurately cut panels to fit around openings and projections. Do not tear face paper or break gypsum core.
C. Apply panels in most economical manner, with ends and edges occurring over supports.
D. Apply panels at fire-rated assemblies as required by design assembly.
E. Stagger joints on opposite sides of partitions.
F. Do not locate joints to align with edges of openings unless a control joint is installed.
G. Mechanically fasten single layer panels to framing. Place fasteners minimum 3/8 inch from edges of panels; drive heads slightly below surface. Stagger fasteners at abutting edges.
H. Apply face layer of double layer applications with joints offset from those in base layer; secure with mechanical fasteners to framing or with adhesive to base layer.
I. At deflection compensating head tracks, cut panels 1/2 inch short of structure at head; do not secure panels to top runner channel.
J. Treat cut edges and holes in moisture resistant gypsum board with joint sealer.
K. Where recessed items occur in fire rated partitions, box item on all sides with gypsum board as required to maintain continuity of fire rating.

3.04 INSTALLATION OF ACOUSTICAL PARTITIONS

A. Extend acoustical partitions past intersecting non-acoustical partitions.

B. Install acoustical insulation:

1. Butt to framing members and adjacent construction.
2. Carry around pipes, wiring, outlets, & other construction without voids.
3. Press against one gypsum board surface to form slight air space on opposite side.

C. Seal acoustical partitions at perimeter and around penetrations:

1. Apply continuous bead of sealer between gypsum panel edges and adjacent construction.
2. Seal space between gypsum panels at control joints, prior to installing metal control joint.
3. Apply sealer to penetrations through partitions.

3.05 INSTALLATION OF CEMENTITIOUS PANELS

A. Install in accordance with ANSI A108.11 and manufacturer's instructions.

B. Apply panels horizontally, with ends occurring over supports. Stagger end joints in adjacent rows.

C. Cut panels to fit around openings and projections.

D. Mechanically fasten panels to framing at maximum 12 inches on center.

3.06 INSTALLATION OF ACCESSORIES

A. Install in accordance with manufacturer's instructions.

B. Install corner reinforcement at outside corners. Use single lengths where length of corner does not exceed standard length.

C. Install casings where indicated and where gypsum board abuts dissimilar materials or stops with edge exposed.

D. Install control joints at ceilings:

1. At maximum 50 feet on center.
2. Where ceiling framing changes direction.

E. Install control joints at walls and partitions:

1. At changes in backup material.
2. At maximum 30 feet on center.
3. Above both jambs of openings in partitions.

3.07 JOINT TREATMENT AND LEVEL OF FINISH

A. Treat joints and fasteners in gypsum board in accordance with GA-214.

B. Levels of Finish:

1. Surfaces in plenums and janitor closets: Level 1 finish.
2. Surfaces to receive tile: Level 2 finish.
3. Surfaces to receive eggshell or satin paints: Level 4 finish.
4. Surfaces to receive semi-gloss and gloss paints: Level 5 finish.

END OF SECTION

SECTION 09 3000
TILING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Manufacturer's installation, cleaning, and maintenance instructions.
   2. Samples:
      a. Tile: Full size samples in each color.
      b. Grout: 1/2 x 1/2 x 3 inch long samples showing available colors.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this section.
B. Tile and Trim Units: Meet ANSI A137.1, Standard Grade.
C. Dynamic Static Coefficient of Friction for Floor Tile: Minimum 0.42, tested DCOF AcuText for ceramic tiles for level interior spaces expected to be walked upon when wet.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver mortar, adhesive, and grout containers bearing hallmark certifying compliance with reference standards.
B. Protect adhesive containers from freezing and overheating according to manufacturer's instructions.

1.04 PROJECT CONDITIONS

A. Environmental Requirements: Maintain minimum ambient temperature of 50 degrees F during and after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Preferred Manufacturer – Tile:
   1. Dal-Tile Corp. (www.daltileproducts.com)
B. Acceptable Manufacturers - Tile:
   1. American Marazzi Tile, Inc. (www.marazzitile.com)
   2. American Olean Tile Co., Inc. (www.aotile.com)
   3. Florida Tile Industries, Inc. (www.floridatile.com)
   4. Summitville Tiles, Inc. (www.summitville.com)
B. Acceptable Manufacturers - Setting and Grouting Materials:
   1. Schluter (www.schluter.com)
   2. Custom Building Products (www.custombuildingproducts.com)
   3. Laticrete International, Inc. (www.laticrete.com)
   4. Mapei Corp. USA. (www.mapei.com)
   5. TEC. (www.tecspecialty.com)

2.02 MATERIALS

A. Tile:
   1. Flooring - **Dal-Tile, Beige Stone Look – Uniche Beige UN12, Matte 12x24 – Alternating Third Pattern.**
   2. Walls – **Dal-Tile, Fabrique, P686 Crème Linen, 12x24 – Alternating Third Pattern (Bathroom Walls).**
   3. Accent Walls **– Dal-Tile, Glass-Caprice Mink F171 – Random Interlocking Pattern (12" Tall Band, Verify with Interior Elevations).**

2.03 ACCESSORIES

A. Latex-Portland Cement Mortar: ANSI A118.4, polymer modified dry set type.
B. Organic Adhesive: ANSI A136.1, Type 1, thin set bond type.
C. Portland Cement: ASTM C150, Type 1, white color.
D. Sand: ASTM C144, clean, free of organic matter.
E. Lime: ASTM C207, Type S, hydrated.
F. Water: Clean, potable.
G. Grout:
   1. ANSI A118.6, polymer modified, cement-based grout. Provide Prism Color Consistent Grout as manufactured by Custom Building Products.
   2. Color: To be selected from manufacturer's full color range.
H. Thresholds: Class A white marble, honed finish, beveled both sides, radiused from bevels to vertical planes, one piece for full width of door or opening.
I. Aluminum Trim: Provide Item No. AB 100 Schlüter - Jolly and Schlüter Schiene aluminum trim as manufactured by Schlüter Systems (phone 800.472.4588 web site: www.schluter.com).
J. Joint Sealers:
   1. Tile Sealer: Aqua Mix Ultra Solv by Custom Building Products.
   2. Wall and Restroom Sealer: Aqua Mix Penetrating Sealer by Custom Building Products.
   3. Mortar Joint Sealant: Sikaflex 1c SL - Single component, self-leveling, premium-grade polyurethane sealant with an accelerated curing capacity.
K. Waterproof Membrane:
   1. Type: Load bearing, pliable sheet-applied polyethylene waterproofing
   2. Source: Schluter- KERDI or approved substitute
L. Crack Suppression Membrane:
   1. Type: Polyethylene uncoupling membrane with a grid structure of square cutback cavities and an anchoring fleece laminated to the underside.
   2. Source: Schlüter-DITRA or approved substitute.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to remove loose and foreign matter that could impair adhesion.
B. Remove ridges and projections. Fill voids and depressions with patching compound compatible with setting materials.

C. Allowable Substrate Tolerances:
   1. Thin set method:
      a. Maximum variation in substrate surface: 1/8 inch in 8 feet.
      b. Maximum height of abrupt irregularities: 1/32 inch.
   2. Thick set method: Maximum 1/4 inch in 10 feet variation in substrate surface.
D. Test concrete substrate to ASTM D 4263; do not install tile until surfaces are sufficiently dry.

3.02 INSTALLATION

A. Install crack suppression membrane and waterproof membrane in strict accordance with manufacturer's written instructions and recommendations.
B. Methods:
   1. Walls: ANSI A108.4, thin set with Portland cement mortar.
   2. Floors: ANSI A108.5, thin set with latex-Portland cement mortar.
C. Minimize pieces less than one half size. Locate cuts to be inconspicuous.
D. Lay tile to pattern furnished by Architect. Do not interrupt tile pattern through openings.
E. Joint Widths:
   1. Ceramic and ceramic mosaic tile: 1/8 inch, plus or minus 1/16 inch.
   2. Paver tile: 1/4 inch, plus or minus 1/8 inch.
F. Make joints watertight, without voids, cracks, excess mortar, or excess grout. Align joints in wall and floor of same-sized tile.
G. Fit tile around projections and at perimeter. Smooth and clean cut edges. Ensure that trim will completely cover cut edges.
H. Install Trim:
   1. Inside corners: Cove units.
   2. Outside corners: Bead units.
   3. Base: Base units.
   4. Exposed tile ends: Bullnose units.
I. Install thresholds where tile abuts dissimilar floor finish. Center on door or opening.
J. Allow tile to set for a minimum of 48 hours before grouting.
K. Grout tile joints in accordance with ANSI A108.10 without excess grout.
L. Control Joints:
   1. Provide control joints at:
      a. Changes in backup material.
      b. Changes in plane.
      c. Over joints in substrate.
      d. Maximum 24 feet on center at interior locations.
   2. Form joints per TCNA Method EJ-171.
   3. Install joint backing and joint sealer as specified in Section 07 9200.

3.03 ADJUSTING

A. Remove and replace pieces that have been damaged during installation.

3.04 PROTECTION

A. Provide protection for completed work using non-staining sheet coverings.

B. Prohibit traffic on tile floors for minimum 3 days after installation.

END OF SECTION

SECTION 09 5100
SUSPENDED ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Installed System: Conform to UL rating for ceiling/floor and ceiling/roof assembly, as follows:
   1. Fire Hazard Classification
      a. Maximum Flame Spread: UL (ASTM E84): 25.
      b. Smoke Developed: 10.

B. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of ceiling suspension system and ceiling tile with 10 years minimum experience.

B. Installer: Company with 3 years minimum experience.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable building code for referenced fire rated assembly and combustibility requirements for materials.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after installation.

1.05 SUBMITTALS

A. Samples: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit the following:
   1. 12 x 12 inch acoustical panel samples.
   2. 6-inch long suspension system samples showing each profile.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store tile and panel cartons open at each end to stabilize moisture content.

1.07 EXTRA STOCK

A. Provide extra quantity of acoustic units under provisions of Section 01 7700 Closeout Procedures.

B. Provide extra panels equal to 2 percent of total for each type used.

C. Store in designated location as directed by Owner.

1.08 COORDINATION

A. Coordinate installation with other trades and make provisions for their work to prevent cutting and patching.

1.09 GUARANTEE

A. The installation of the acoustical material shall be guaranteed to be tight and remain in place for 2 years after final acceptance of the building. Any loose or falling materials shall be replaced by Contractor at his own expense.

1.10 PROJECT CONDITIONS

A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Schedule installation of acoustic units after interior wet work is dry.
C. Humidity: 20-40 percent prior to, during, and after installation.
D. Temperature: 61 degrees F minimum, prior to, during, and after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Suspension System:
   1. Armstrong World Industries, Inc. (www.armstrong.com/commceilingsna)
   2. Chicago Metallic Corporation. (www.chicago-metallic.com)
   3. USG Interiors, Inc. (www.usg.com)
B. Acceptable Manufacturers - Acoustical Units:
   1. Armstrong World Industries, Inc. (www.armstrong.com/commceilingsna)
   2. CertainTeed Corporation (www.certainteed.com)
   3. USG Interiors, Inc. (www.usg.com)

2.02 MATERIALS

A. Suspension Grid System:
   1. ASTM C 635, die cut, interlocking ends; heavy duty for AC-2, intermediate duty for other acoustical panels.
   2. Grid type: Exposed T.
   3. Material: Galvanized steel.
   4. Runners: 1-1/2 inches high, 15/16 inch exposed width, profile.
   5. Perimeter molding: Angle shape.
   6. Finish: Factory applied enamel paint, sprayed and baked, white color to match acoustical panels.
   7. Accessories: Stabilizer bars, hold-down clips, and splices.
B. Acoustical Panels (AC-1):
   1. Source: Cortega by Armstrong or approved substitute.
   2. Size: 24 x 24 inches x 5/8 inch thick.
   3. Edge Configuration: Angled tegular.
   4. Acoustics (NRC): 0.55
C. Acoustical Panels (VC-1):
   1. Source: Sheetrock™ Lay-in Ceiling Panel ClimaPlus™ Vinyl by USG or approved substitute.
   2. Size: 24 x 24 inches x 1/2 inch thick.
   3. Edge Configuration: Square.
   4. Acoustics (NRC): 0.55
   5. Panels shall be USDA/FSIS requirements for food processing areas.

2.03 ACCESSORIES

A. Support Channels: Prime painted steel; size and type to suit application.

B. Hanger Wire: ASTM A641, minimum 12 gage galvanized steel.

C. Hold Down Clips: Minimum 24 gage spring steel, manufacturer's standard profile.

D. Touch-Up Paint: Color to match acoustical panels and suspension grid.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install ceilings in accordance with ASTM C 636 and CISCA Handbook.

B. Minimize panels less than one half size.

C. Install molding around perimeters and abutting surfaces. Miter molding at exterior corners; cut flanges and bend web to form interior corners.

D. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment.

E. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.

F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.

G. Where ducts or other equipment prevent regular spacing of hangers:

1. Reinforce nearest related hangers to span extra distance, or:

2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.

H. Install main tees at maximum 48 inches on center.

I. Install cross tees to form 24 x 24 inch modules. Lock cross tees to main tees.

J. Support ends of tees on flange of perimeter molding.

K. Place acoustical panels with edges resting flat on suspension grid.

L. Cutting Acoustic Units:

1. Cut to fit irregular grid and perimeter edge trim and around penetrations.

2. Locate cuts to be concealed.

3. Cut and field paint exposed edges of reveal edge units to match factory edge.

M. Place hold down clips over cross tees at mid-point of each module.

N. Installation Tolerances: Ceilings level to 1/8 inch in 12 feet measured in any direction.

3.02 ADJUSTING

A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

SECTION 09 6520
RESILIENT FLOORING – LUXURY VINYL TILE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Luxury Vinyl Tile.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004, with Editorial Revision (2014).

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2013a.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.03 SUBMITTALS

A. Samples: Submit in accordance with Section 01 3300 - Submittal Procedures.

1. Tile: 6 x 6-inch samples showing available colors.

2. Base: 4-inch long samples showing available colors.

3. Reducers: 4-inch long samples showing available colors.

1.04 DELIVERY, STORAGE AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.05 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Luxury Vinyl Tile: Printed film type, with transparent or translucent wear layer.

1. Manufacturers:

a. Karndean, K-Trade Flooring; Luxury Flooring: www.ktradeflooring.com.

2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.

3. Square Tile Size: 18 by 18 inch (457 by 457 mm).
4. Wear Layer Thickness: 0.020 inch (0.50 mm).
5. Total Thickness: 0.125 inch (3 mm).
6. Color: Woodplank - BU103, 36” x 7”

2.02 RESILIENT VINYL BASE

A. Resilient Vinyl Base: ASTM F1861, Type TV vinyl; top set, group 2 Style B, Cove.
1. Manufacturers:
a. Roppe Corporation; Traditional Wall Base: www.roppe.com
2. Height: 4 inch (100 mm).
3. Height: 6 inch (152 mm)
4. Thickness: 0.125 inch (3.2 mm).
5. Finish: Satin.
6. Color: **P194 ‘Burnt Umber’ – Verify with Architect**.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Moldings, Transition and Edge Strips: Same manufacturer as resilient base, Color: TA4 Gateway WG.
1. Profiles: T-transition, ramp reducers or edge as appropriate for conditions.
D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Test in accordance with ASTM F710.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
C. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - LUXURY VINYL TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 36 inches (90 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 7733
SANITARY WALL PANELS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Samples: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit the following:
   1. 6 x 6 inch panel samples showing available colors.
   2. 6 inch long trim samples.

1.02 QUALITY ASSURANCE

A. Fire Hazard Classification: Tested to ASTM E 84.
   1. Flame Spread: Maximum 25.
   2. Smoke Density: Maximum 450.

1.03 PROJECT CONDITIONS

A. Do not install products if temperature, humidity, and ventilation requirements are outside limits recommended by manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Crane Composites (www.cranecomposites.com)
   2. Nudo Products, Inc. (www.nudo.com)
   3. Marlite (www.marlite.com)
   4. Panolam Industries International, Inc. (www.panolam.com)

2.02 MATERIALS

A. Sanitary Wall Panels:
   1. Type: Glass fiber reinforced plastic, USDA approved for incidental food contact.
   2. Size: 3/32 inch thick x 48 inches wide x maximum practical length.
   3. Color: To be selected from manufacturer's full color range.
   4. Surface texture: High gloss, smooth.

2.03 ACCESSORIES

A. Trim:
   1. One piece extruded PVC, manufacturer's standard profile.
   2. Inside and outside corners, division bar, and J-molding.
   3. Color: To be selected from manufacturer's full color range.
B. Adhesive: Compatible with panels and substrate; recommended by panel manufacturer.
C. Joint Sealer: Specified in Section 07 9200.
D. Patching Compound: White latex type.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare substrate to receive panels:
   1. Remove high spots.
   2. Fill low spots with patching compound; sand smooth.
   3. Remove loose and foreign matter that could impair adhesion.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations.
B. Install Trim:
   1. Panel-to-panel Joints: Division bar.
   2. Internal and external corners.
   3. Exposed Edges: J molding.
   4. Secure to substrate.
C. Cut panels to fit at perimeter and around penetrations. Ensure that trim will completely cover cut edges.
D. Maintain 1/8 to 3/16 inch expansion space at perimeter and around penetrations.
E. Adhere panels to substrate with continuous beads of adhesive.
F. Install continuous bead of joint sealer between panels and trim and between trim and adjacent construction.

END OF SECTION

SECTION 09 9100
PAINTING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Submittal Procedures. Manufacturer's data on materials proposed for use. Include:
   1. Product designation and grade.
   2. Surface preparation materials and procedures.
   3. Product analysis and performance characteristics.

1.02 DELIVERY, STORAGE AND HANDLING

A. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

B. Paint Materials: Store at ambient temperature from 45 to 90 degrees F in ventilated area, or as required by manufacturer's instructions.

1.03 PROJECT CONDITIONS

A. Do not apply materials when surface and ambient temperatures or relative humidity are outside ranges required by manufacturer.

B. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Benjamin Moore and Co. (www.benjaminmoore.com)
   2. Glidden. (www.gliddenprofessional.com)
   3. Kelly-Moore Paints. (www.kellymoore.com)
   4. PPG Architectural Finishes, Inc. (www.pittsburghpaints.com)
   5. Pratt and Lambert Paints. (www.prattandlambert.com)
   6. Sherwin Williams. (www.sherwin-williams.com)

2.02 MATERIALS

A. Paints: As scheduled at end of section, or approved substitute.

2.03 ACCESSORIES

A. Accessory Materials: Paint thinners and other materials required to achieve specified finishes; commercial quality.

B. Patching Materials: Latex filler.

C. Fastener Head Cover Materials: Latex filler.

2.04 MIXES

A. Uniformly mix to thoroughly disperse pigments.

B. Do not thin in excess of manufacturer's recommendations.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:
   1. Protect adjacent and underlying surfaces.
   2. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
   3. Correct defects and clean surfaces capable of affecting work of this section.
   4. Seal marks that may bleed through surface finishes with shellac.

B. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow to dry.

C. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

D. Concrete and Masonry:
   1. Remove dirt, loose mortar, scale, salt and alkali powder, and other foreign matter.
   2. Remove oil and grease with solution of trisodium phosphate; rinse and allow to dry.
   3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

E. Concrete Floors:
   1. Remove contamination, acid etch, and rinse floors with clear water. Allow to dry.
   2. Verify that required acid-alkali balance has been achieved.

F. Plaster:
   1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Finish smooth and flush with adjacent surfaces.
   2. Wash and neutralize high alkali surfaces.

G. Galvanized Steel: SSPC Method SP1 - Solvent Cleaning.

H. Aluminum: SSPC Method SP1 - Solvent Cleaning.

I. Uncoated Ferrous Metals:
   1. SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
   2. Spot prime paint after repairs.

J. Shop Primed Ferrous Metals:
   1. SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
   2. Feather edges to make patches inconspicuous.
   3. Prime bare steel surfaces.

K. Interior Wood:
   1. Wipe off dust and grit.
   2. Seal knots, pitch streaks, and sappy sections with sealer.
   3. Fill nail holes and cracks after primer has dried; sand between coats.

3.02 APPLICATION

A. Apply primer or first coat immediately after surface preparation is complete to prevent recontamination.
B. Do not apply finishes to surfaces that are not dry.
C. Apply coatings to minimum dry film thickness recommended by manufacturer.
D. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
E. Apply coatings to uniform appearance without laps, sags, curtains, holidays, and brush marks.
F. Allow applied coats to dry before next coat is applied.
G. Sand between coats on interior wood and metal surfaces.
H. Match final coat to approved color samples.
I. Where clear finishes are specified, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
J. Prime concealed surfaces of interior wood in contact with masonry or cementitious materials with one coat primer paint.
K. Mechanical and Electrical Components:
    1. Paint factory primed equipment.
    2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
    3. Paint exposed and insulated pipes, conduit, boxes, ducts, hangers, brackets, collars, and supports unless factory finished.
    4. Do not paint name tags or identifying markings.
    5. Paint exposed conduit and electrical equipment in finished areas.
L. Do not Paint:
    1. Surfaces indicated on drawings or specified to be unpainted or unfinished.
    2. Surfaces with factory applied finish coat or integral finish.
    3. Architectural metals, including brass, bronze, stainless steel, and chrome plating.

3.03 ADJUSTING

A. Touch up or refinish disfigured surfaces.

3.04 CLEANING

A. Remove paint from adjacent surfaces.

3.05 PAINT SCHEDULE

A. Types of paint listed herein are set forth as standard of quality and type of coating required for each type of surface.
    1. Paint exposed surfaces of types listed in Paint Schedule.
    2. Paint other exposed surfaces not specifically listed with not less than two coats of appropriate type of coating.
B. Prime coat shall consist of touch up only on shop primed surfaces.

SUBSTRATE	MANUFACTURER	PRIMER	TOP COATS
Exterior Surfaces:			
Ferrous and Galvanized Metals	Sherwin Williams	Pro-Cryl Acrylic Primer	DTM Gloss Alkyd Enamel
Concrete Unit Masonry	Sherwin Williams	Preprite Block Filler	Loxon Acrylic Masonry Finish
AESS	Tnemec	- - -	Endura-Shield Series 1080
Interior Surfaces:			
Gypsum Board, Epoxy	Sherwin Williams	Preprite Problock Primer/Sealer	Pro-Industrial High Performance Epoxy
Gypsum Board	Sherwin Williams	Multi-Purpose Latex PVA Primer/Sealer	Pro-Classic Semi-Gloss Enamel
Exposed Roof Structure	Sherwin Williams	None	All Surface Satin Latex
Ferrous Metals	Sherwin Williams	Pro-Cryl Acrylic Rust-Preventative Primer	DTM Gloss Alkyd Enamel
Galvanized Metals	Sherwin Williams	Pro-Cryl Acrylic White Rust Inhibitive Primer	DTM Gloss Alkyd Enamel
Concrete Masonry Units	Sherwin Williams	Preprite Block Filler	Pro-Industrial High Performance Epoxy
Concrete Floors	Sherwin Williams	None None	Armorseal WB Epoxy Primer/Sealer
Wood, Opaque	Sherwin Williams	A-100 Alkyd Enamel Undercoat Primer	Pro-Classic Alkyd Semi-Gloss Enamel

END OF SECTION

SECTION 10 1400
IDENTIFYING DEVICES

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies interior signage for room numbers, directional signs, exterior signage, and code required signs.

B. This section specifies the fabrication and installation of exterior illuminated monument sign.

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.

1. Shop Drawings; Dimensional Letters: Indicate character style, layout, dimensions, materials, finishes, and attachment.

3. Shop drawings; Monument Sign: Submit overall signage design, indicate character style, layout, dimensions, materials, finishes and attachment. Include structural design intent, wind load, snow load, and electrical/lighting design to be submitted to architect for approval. All structural designs shall be signed & sealed by a licensed structural engineer.

4. Samples; Interior Panel Signs:

a. 3 x 3 inch sign samples showing available colors.

b. Typical letter in specified size, style, and finish.

5. Product Data; Photoluminescent Sign / Markers: Submit manufacturer’s product information, including installation instructions for photoluminescent sign / markers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Interior Panel Signs:

1. APCO Graphics, Inc. (www.apcosigns.com)

2. Best Sign Systems, Inc. (www.bestsigns.com)

3. Seton Identification Products. (www.seton.com)

B. Acceptable Manufacturers - Dimensional Letters (Building and Monument Sign):

1. A.R.K. Ramos Mfg. Co., Inc. (www.arkramos.com

2. Gemini, Inc. (www.signletters.com)

3. Livers Bronze Co., Inc. (www.liversbronze.com)

C. Acceptable Manufacturers - Photoluminescent Sign / Markers:

1. Active Safety (www.activesafety.com)

2. Luminous Pathways, LLC (www.luminouspathways.com)

3. Zero International (www.zerointernational.com)

2.02 MATERIALS

A. Signs: Provide minimum of one sign for all rooms / spaces.

1. Type: Melamine plastic laminate with contrasting color core, non-static, fire-retardant, self extinguishing, matte finish.

2. Thickness: 1/8 inch.

3. Face and core colors: To be selected from manufacturer's full color range.

B. Dimensional Letters - Aluminum Castings: ASTM B 85, alloy and temper best suited to application on face of building and monument sign

2.03 ACCESSORIES

A. Fasteners: Concealed, same material as plaque, type best suited to application.

B. Sign Tape: Double sided, waterproof, pressure sensitive.

C. Anchors - Dimensional Letters: Type best suited to application.

2.04 FABRICATION - SIGNS

A. Fabricate signs by reverse engraving process to produce characters and graphics in contrasting color, raised 1/32 inch.

B. Characters:

1. Height: 5/8 inch.
2. Style: Serif style to be selected, upper case.
3. Width to height ratio: Between 3:5 and 1:1.
4. Stroke width to height ratio: Between 1:5 and 1:10.

C. Pictograms: Universal accessibility symbols, 6 inches high.

D. Provide Braille indications for each character.

E. Corners: Square.

F. Edges: Beveled.

2.05 FABRICATION - DIMENSIONAL LETTERS

A. Cast letters from aluminum, free from pits, gas holes, and warped surfaces.

B. Hand tool to sharp, clean edges.

C. Character Style: Helvetica.

D. Height: 10 inches.

E. Mounting Method: Flush-mount.

F. Finish: Dark Bronze to be selected from manufacturer's color palette. Submit sample for review.

2.06 FABRICATION – ILLUMINATED MONUMENT SIGN:

A. Provide an illuminated sign mounted on a concrete base with a reveal between the base and the sign structure.

B. Construct free standing monument sign outside but adjacent to the proposed route right of way as shown on the site plan.

a. Sign location to be staked in the field and to be reviewed and approved by architect and owner prior to installation.

b. Free standing monument sign to have two identical sign faces on either side of the monument sign.

c. Sign to be manufactured out of sheet aluminum and sealed with appropriate waterproofing sealant and fasteners. Framing and structural support to be manufactured out of steel and aluminum and designed/engineered by the sign manufacturer.

d. Harrison Family Dental logo and color scheme to be used. Sign shall be painted with a high quality enamel finish, smooth and free of blemishes. Harrison Family Dental text shall be Helvetica font, 10” tall lettering. All text shall be manufactured out of dark bronze aluminum and illuminated from ground

lighting. All text is to have a crisp look when illuminated and have a high contrast effect both during the day and at night.

e. Lighting for sign shall be stanchion mounted ground light fixture at either side of sign. Provide 120V Swivel Photocell Light by 'RAB Lighting' Model FFLED52B44W/PCS, Dark Bronze.

f. Contractor to provide shop drawings depicting text and logo design for approval. It is recommended that the sign manufacturer review all dimensions and specifications and provide input to architect to ensure an efficient use of material while maintaining the design intent of the sign. Any changes to the design, dimensions, or specifications must be approved by architect.

PART 3 - EXECUTION

3.01 INSTALLATION - INTERIOR PANEL SIGNS

A. Install signs in accordance with manufacturer's written instructions and recommendations.

B. Locate signs on wall adjacent to scheduled doors.

3.02 INSTALLATION - DIMENSIONAL LETTERS

A. Install letters in accordance with manufacturer's written instructions and recommendations.

B. Set plumb, level, rigid, and aligned.

3.03 INSTALLATION - PHOTOLUMINESCENT SIGN / MARKERS

A. Install photoluminescent sign and egress markers in strict accordance with manufacturer's written instructions and recommendations.

3.04 INSTALLATION – MONUMENT SIGN

A. Base of sign shall sit on finished grade with appropriate weep holes, grade slope, and water proofing material implemented to ensure minimum risk or rust or other water damage.

B. Existing electric lines to be utilized for all light fixtures. New electrical lines installed below grade from the recreation center building to the proposed monument sign shall be bid as an alternative.

C. Structural sign foundation/footings to be designed by structural engineer registered in the state of Texas.

D. All fasteners shall be stainless steel.

E. Final grade at the sign base shall be as indicated on the site plan and the grade cut to meet this elevation shall be evenly spread around the sign, all disturbed areas around sign shall maintain 6" topsoil, proposed shrubs and perennials shall be installed as per the landscape plan and specs.

F. Contractor shall locate all utilities prior to construction. Contractor is to obtain all city permits necessary prior to construction. Permits shall be submitted to architect for record.

END OF SECTION

SECTION 10 2600
WALL AND DOOR PROTECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Corner Guards
B. Crash Rails
C. Handrails
D. Bumper Guards
E. Protective Wall covering

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Indicate profiles, accessories, and attachments.
   2. Shop drawing: Submit shop drawings showing components, dimensions, anchorage details.
   3. Samples for selection and verification of product pattern and finish.

1.03 QUALITY ASSURANCE

A. Manufacturer: A firm regularly engaged in the manufacturing of wall protection system components similar to those specified
B. Installer: Engage a skilled installer with no less than three years of documented experience installing similar types of products to the extent and complexity of those required for the project.
C. Code Compliance: Provide product that conforms to the necessary requirements of all applicable codes.
D. Single source responsibility: Provide all product systems components from a single source.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly indicating manufacturer and material.
B. Storage: Store materials indoors in a clean, dry area protected from damage where temperature and humidity remain stable and within 40F (4C) to 100F (38C). Materials must be stored flat.
C. Handling: Protect materials during handling and installation to prevent damage

1.05 PROJECT CONDITIONS

A. Environmental conditions: Do NOT install wall surface protection systems until the installation area is enclosed and weatherproof, and until the ambient temperature within the building is maintained at not less than 70F (21C) for not less than 72 hours prior to installation.
B. Installation locations must be enclosed weatherproofed, and climate controlled prior to commencing installation.

1.06 WARRANTY

A. Submit supplier's written warranty against defects in material and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products by following manufacturers:

1. Construction Specialties, Inc. (www.c-sgroup.com)
2. Inpro Corporation. (www.inprocorp.com)
3. Nystrom, Inc. (www.nystrom.com)
4. Pawling Corp. (www.pawling.com)

2.02 COMPONENTS

A. Corner Guards:

1. Type: Surface mounted, stainless steel, minimum 16 gage.
2. Attachment: Countersunk fasteners. Integral with Tile.
3. Size: 3-1/2 inches x 3-1/2 inches x 48 inches high.
4. Finish: No. 4 satin.

B. Crash Rails:

1. Stainless Steel Crash Rails:
   a. Cover Material: 16 Gauge, Type 304 Stainless Steel, Satin No. 4 finish
   b. Retainer: Wood rail
   c. Size: 4 inches
   d. Mounting: Surface mount
   e. Option: 5 1/2 inches with V-Groove cover
2. Vinyl Crash Rails: mounted over continuous aluminum retainer. Exposed surfaces shall be free of wrinkling, chipping, discoloration, or other imperfections.
   a. Cover Material: high impact vinyl acrylic extrusion locked in place, nominal 0.078 inch thick.
   b. Retainer material: continuous 6063 T-4 aluminum retainer, nominal 1.100 inch thick
   c. Sizes: 4 inches, 6 inches, 8 inches
   d. Surface mount 1/2 inch
   e. Color: to be selected from manufacturer options

C. Bumper Guards:

1. Vinyl bumper guard:
   a. Cover Material: High impact vinyl acrylic extrusion locked into place, 0.078 inch
   b. Retainer: Continuous plastic retainer, nominal 0.080 inch
   c. Size: 2 inches
   d. Surface Mounted

D. Protective Wall Covering

1. Stainless Steel Wall Covering:
   a. Material: Stainless Steel Type 304 finish
   b. Thickness: 16 gauge
2. Vinyl wall covering; rigid high impact sheet
   a. Material: Chemical and stain resistant high-impact acrylic modified vinyl plastic sheets
   b. Thickness: 0.040 inch
   c. Sheet Size: 4 foot x 8 foot
   d. Fire Rating: Class A

2.03 ACCESSORIES

A. Fasteners: Type best suited to application, exposed heads of stainless or plated steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the substrates and conditions under which the work is to be performed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations.
B. Secure metal retainers to framing.
C. Secure corner guards with fasteners.
D. Set plumb, level, and rigid.

3.03 CLEAN-UP

A. Upon completion of the work, remove excess materials, debris and rubbish resulting from the installation and leave the area in a clean and orderly condition.

END OF SECTION

SECTION 10 2813
TOILET ACCESSORIES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Schedule accessories by room; show plans and elevations, and identify room name and number, type and quantity of accessories, and mounting heights.
B. Warranty: Sample warranty form.

1.02 WARRANTIES

A. Furnish manufacturer's 10-year warranty providing coverage against mirror silver spoilage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. A and J Washroom Accessories. www.ajwashroom.com
   2. American Specialties, Inc. www.americanspecialties.com
   3. Bobrick Washroom Equipment, Inc. www.bobrick.com
   4. Bradley Corp. www.bradleycorp.com
   5. General Accessory Mfg. Co. www.gamcousa.com
   6. Consentino. www.consention.com

2.02 MATERIALS

A. Stainless Steel:
   1. Sheet: ASTM A 167, Type 304, rollable temper.
   2. Tubing: ASTM A 269.
B. Galvanized Steel: ASTM A 1008.
C. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q1, 3/16 inch thick.

2.03 ACCESSORIES

A. Fasteners: Stainless steel where exposed, hot-dip galvanized where concealed; type best suited to substrate conditions.

2.04 FABRICATION

A. Use stainless steel for exposed surfaces; galvanized steel may be used in concealed locations.
B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.
C. Weld joints of fabricated components and grind smooth.
D. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.
E. Fabricate soap dispensers to operate with less than 5 pound force.
F. Provide hangers, adapters, anchor plates, and accessories required for installation.
G. Key locks alike; furnish six keys.
H. Mirrors:

1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered and welded.
2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing com pound to back surface of glass.
3. Backing: Galvanized steel sheet.
4. Isolate glass from frame and backing with resilient, waterproof padding.

I. Shop assemble units and package complete with anchors and fittings.

2.05 FINISHES

A. Stainless Steel: No. 4 satin.

B. Galvanizing: ASTM A 123 to 1.25 ounces per square foot.

C. Chrome Plating: ASTM B 456, Type SC 2, polished.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Set plumb, level, square, and rigid.

3.02 SCHEDULE

NO. DESCRIPTION	MANUFACTURER	MODEL NO.
Toilet Tissue Dispenser	Bobrick	B-2740 or B-2888
Feminine Tampon/Napkin Disposal	Bobrick	B-270
Robe Hook	Bobrick	B-672
Grab Bars	Bobrick	B-6106
Soap Dispenser	Gojo	2789-12 Nickel
Mirrors	Bobrick	B-165 24" x 36"
Lighted Mirrors	Bobrick	B-167 24" x 36"
Utility Shelf	Bobrick	B-298
Mop Holder	Bobrick	B-223 x 36

END OF SECTION

SECTION 10 4413
FIRE EXTINGUISHERS AND CABINETS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures. Include data on extinguishers and cabinets, brackets, operational features, materials, finishes, and anchorage.

B. Closeout Submittals:

1. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.04 QUALITY ASSURANCE

A. Provide fire extinguishers complying with UL 711 and NFPA 10.

1.05 PROJECT CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. JL Industries. www.jlindustries.com
2. Larsen's Mfg. Co. www.larsensmfg.com
3. Potter Roemer. www.potterroemer.com

2.02 COMPONENTS

A. Extinguishers: Multi-purpose dry chemical type, UL 299, cast steel tank, Class 2A:10B:C,5 pound nominal capacity.

B. Cabinets:

1. Formed stainless steel sheet, 18 gage minimum.
2. Configuration: Semi-Recessed (JL Industries Model #1017F10), sized to accommodate extinguishers.
3. Trim: Returned to wall surface.
4. Door:
   a. Full glass style, equipped with recessed pull handle and latch.
   b. Hinge doors for 180 degree opening with continuous piano hinge.
   c. Glazing: Clear tempered glass.

C. Brackets: Formed galvanized steel, sized to accommodate extinguisher.

2.03 ACCESSORIES

A. Mounting Hardware: Type best suited to application.

2.04 FINISHES

A. Cabinet:

1. Exterior and Door: Baked enamel, white.

2. Interior: Baked enamel, white.

B. Brackets: Baked enamel, white color.

C. Extinguishers: Baked enamel, red color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cabinets and brackets in accordance with manufacturer's written instructions and recommendations.

B. Set plumb, level, and rigid.

C. Place an extinguisher in each cabinet and on each bracket where indicated.

END OF SECTION

SECTION 10 7500
GROUND-SET FLAGPOLES

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design flagpole and anchorage devices in accordance with ANSI/NAAMM FP 100197.
   2. Minimum design wind speed: 110 MPH; 3-second gust speed at 50 feet above ground.

B. Pole Description:
   1. Type: Ground set.
   2. Pole: Cone tapered.
   3. Dimensions:
      a. Exposed height: 35 feet.
      b. Overall height: 40 feet.
      c. Ball diameter: 5 inches.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 3300 - Submittal Procedures. Include pole and base dimensions, materials, finishes, and accessories.

1.03 DELIVERY, STORAGE AND HANDLING

A. Wrap poles in heavy paper to prevent damage during shipping and handling.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. American Flagpole, Inc. (www.americanflagpole.com)
   2. Baartol Co., Inc. (www.baartol.com)
   3. Concord Industries, Inc. (www.concordindustries.com)
   4. Ewing International Corp. (www.ewingflagpole.com)
   5. Pole-Tech Co., Inc. (www.poletech.com)

2.02 MATERIALS

A. Aluminum: Entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

B. Concrete: ASTM C 94; 3000 psi 28 day strength, 2 to 3 inch slump.

2.03 COMPONENTS

A. Pole: Seamless aluminum pipe.

B. Fittings:
   1. Ball: Spun aluminum.
   2. Truck: Revolving, non-fouling, cast aluminum.
   3. Halyard: External type, 3/8 inch diameter braided nylon rope with two stainless steel swivel snap hooks.

4. Cleat: 9 inch long cast stainless steel.
5. Collar: Cast aluminum, minimum 1 inch larger in diameter than foundation sleeve.
6. Foundation sleeve: 16 gage, 10 inch diameter, galvanized, corrugated steel with 3/8 inch base plate.
7. Provide minimum 12 inch long lightning rod with setting plate and one set each steel and hardwood centering wedges.

2.04 FINISHES

A. Aluminum: AAMA 611, Architectural Class II anodized to 0.0007 inch minimum thickness, medium bronze anodized.

B. Apply bituminous coating to that part of flagpole to be set in base, inside & out.

2.05 MISCELLANEOUS MATERIALS

A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

B. Sand: ASTM C 33/C 33M, fine aggregate.

C. Elastomeric Joint Sealant: Multicomponent non-sag urethane joint sealant complying with requirements in Division 07 Section “Joint Sealants.”

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

E. Place concrete, as specified in Division 03 Section “Cast-in-Place Concrete.” Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use non-staining curing compound.

F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.02 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated & according to approved Shop Drawings & manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 10 9900
MISCELLANEOUS SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Related Sections: Provisions established in General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

B. Section Includes:

1. Miscellaneous specialty items as listed herein.

1.01 SUBMITTALS

A. General: Submit following items in accordance with Submittal Procedures.

B. Product Data: Including all pertinent performance characteristics and criteria.

C. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.

D. Manufacturer's Instructions: For installation, maintenance, and repair.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle, and protect products in accordance with Section 01 6000.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Fire Control Key Box: Provide recessed fire department key control box, equal to model 3200 by Knox Box, one at main building entrance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this Section.

B. Notify Architect of any existing conditions which will adversely affect execution.

C. Beginning of execution will constitute acceptance of existing conditions.

3.02 PREPARATION

A. Prepare substrate surfaces as recommended by manufacturer.

3.03 INSTALLATION

A. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

3.04 ADJUSTING

A. Adjust and fit items to be flush with adjacent construction.

B. Fasten or adhere for tight connections and joints.

3.05 CLEANING

A. Perform final cleaning in accordance with Closeout Procedures.

3.06 PROTECTION

A. Protect finished installation in accordance with Section 01 6000.

END OF SECTION

SECTION 11 3100
APPLIANCES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Provide product data on appliances showing materials, finishes, characteristics, limitations, and electrical characteristics.
   2. Warranty: Sample warranty form.
B. Closeout Submittals:
   1. Operation and Maintenance Data.

1.02 DELIVERY, STORAGE AND HANDLING

A. Deliver appliances with manufacturer's protective coverings in place; do not remove until just prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. GE Appliances. (www.geappliances.com)
   2. KitchenAid. (www.kitchenaid.com)
   3. Maytag Co. (www.maytag.com)
   4. Sears Contract Sales. (www.contractsales.sears.com)
   5. Napoleon Fireplaces. (www.napoleonproducts.com)
   6. Dimplex Fireplaces. (www.dimplex.com)

2.02 MANUFACTURED UNITS

A. Appliances: Scheduled at end of section.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install appliances in accordance with manufacturer's written instructions and recommendations.
B. Set plumb, level, and aligned.
C. Connect to domestic water system s.
D. Connect to power supply.

3.02 ADJUSTING

A. Adjust appliances for proper operation.

3.03 SCHEDULE

APPLIANCE DESCRIPTION	MANUFACTURER	MODEL	FINISH
Refrigerator	GE Appliances	GTE18ISHSS	Stainless Steel
Microwave	GE Appliances	PEB7226SF/EH	Stainless Steel
Dishwasher	GE Appliances	PDT760SSF	Stainless Steel
Stackable Washer	GE Appliances	GFW430SSMWW	White-On-White
Stackable Dryer	GE Appliances	GFD43ESSMWW	White-On-White
Disposer	Insinkerator	Badger 5XP	Grey Enamel
Flat Screen Wall Mount	Future Automation	PS40	Black
Flat Screen Wall Box	Future Automation	WB21	Galvanized

END OF SECTION

SECTION 12 0000
MOVEABLE FURNITURE & EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Section 01 6400 - Owner Furnished Contractor Installed Products.

1.02 SUMMARY

A. Section Includes:

1. Moveable furniture and equipment.

1.03 COORDINATION

A. Coordinate the work with the Owner's Facilities Manager. The Owner shall provide a list of furniture and fixtures to be moved and installed prior to construction. Contractor shall coordinate the work with the location and placement of utilities. Contractor shall coordinate characteristics of utilities with the requirements of the equipment.

B. Preconstruction Meeting: Prior to the delivery of any furniture to the site, the Contractor(s) must convene, attend and document a preconstruction meeting with the Architect, General Contractor and facility personnel to determine the delivery and installation coordination requirements and the expectations for the furnishing of the project. The meeting must produce a comprehensive, cooperatively produced schedule for the furniture contractor's operations during the course of the installation works.

PART 2 - PRODUCTS

2.01 MOVEABLE FURNITURE AND EQUIPMENT

A. Coordinate with Owner and Architect for identification and placement of moveable furniture and equipment.

PART 3 - EXECUTION

3.01 EXAMINATION AND INSTALLATION

A. Examine furniture and equipment before installation and proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Product Data: Describe blind construction and finishes.
   2. Samples: 3-inch-long slat samples showing available colors.

1.02 PROJECT CONDITIONS

A. Do not install blinds until painting and finishing work is complete.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Hunter Douglas, Inc. (www.hunterdouglas.com)
   2. Levolor Contract. (www.levolor.com)
   3. SWF Contract. (www.swfcontract.com)

2.02 COMPONENTS

A. Louver Slats: 1-inch wide, pre-finished spring tempered aluminum, horizontal slats with radiused corners.
B. Slat Support: Woven polypropylene ladders.
C. Head Rail: Pre-finished, formed aluminum or steel box, internally fitted for hardware, pulleys, and bearings for blind operation.
D. Cord: Braided nylon or polypropylene.
E. Control Wand: Hollow extruded plastic, height of window opening less 12 inches.
F. Support Brackets: Suitable for wall or soffit mounting, formed metal to match head rail, allowing removal of head rail for maintenance without removing bracket.
G. Operation: Full-range lift locking.

2.03 FABRICATION

A. Fabricate blinds to fit openings with uniform edge clearance of 1/4 inch.
B. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/4 inch between assemblies, occurring at window mullion centers.

2.04 FINISHES

A. Slats: Static-reducing baked enamel, color to be selected from manufacturer's full color range.
B. Head Rails and Brackets: Static-reducing baked enamel, color to match slats.
C. Ladders and cords: Dyed to closely match slats.
D. Control Wands: Clear.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install blinds in accordance with manufacturer's written instructions and recommendations.

B. Secure with concealed fasteners.

C. Place intermediate head supports at maximum 48 inches on center.

D. Installation Tolerances:

1. Maximum gap at window opening perimeter: 1/4 inch.

2. Maximum offset from level: 1/8 inch.

3.02 ADJUSTING

A. Adjust blinds for proper operation.

END OF SECTION

SECTION 12 2413
ROLLER WINDOW SHADES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes
   1. Manually operated roller shades
   2. Motor operated roller shades with double rollers

1.02 REFERENCES

A. National Fire Protection Association (NFPA) 701

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets shall be submitted for each product specified, including:
   1. Preparation instructions and recommendations
   2. Finishes, material descriptions, dimensions of individual components
   3. Construction and installation instructions
   4. Manufacturers recommendations for maintenance and cleaning

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
   1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of roller shade.
   1. Shadeband Material: Not less than 3 inches square. Mark inside face of material if applicable.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

E. Electric shade motors shall comply with UL standards. Copy of compliance available for submission upon request.

1.04 QUALITY ASSURANCE

A. Supplier: Manufacturer, subsidiary or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.

B. Installer: Installer or agent shall be qualified to install specified products by prior experience, demonstrated performance and acceptance of requirements of manufacturer, subsidiary, or licensed agent. Installer shall be responsible for an acceptable installation.

C. Uniformity: Provide Manual & Motorized Roller Shades of only one manufacturer for entire project.

1.05 DELIVERY, STORAGE AND HANDLING

A. Product shall be delivered to site in manufacturer's original packaging.

B. Product shall be handled and stored to prevent damage to materials, finishes and operating mechanisms.

1.06 JOB CONDITIONS

A. Prior to shade installation, building shall be enclosed.

B. Interior temperature shall be maintained between 60° F. and 90° F. during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.

C. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for it intended use.

D. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:

1. Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty.
2. Electronic Roller Shade EDU's and EDU Control Systems: Manufacturer's standard non-depreciating five (5) year warranty.
3. Roller Shade Installation: One (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Hunter Douglas Architectural: 13915 Danielson St., Ste.100, Poway, CA 92064;
Website: www.HDarchitectural.com, or architect approved equivalent.

B. MechoSystems

C. Lutron Shading Systems

D. Source Limitations: Obtain roller shades from single source from single manufacture.

2.02 MANUAL ROLLER SHADES

A. Product: Hunter Douglas Architectural “RB 500 Manual Roller Shades”

B. Materials:

1. Fabrics: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, & blackout fabrics providing 0% -14% openness factors. Fabric weights to range between 6.00 oz/sq.yd. - 20.70 oz/sq.yd., containing fiberglass, PVC, polyester, acrylic, vinyl laminates, cotton, & vinyl coatings. Finish selected by architect from manufacturer’s available contract colors.
2. Control Systems:
   a. Clutch Operated: Engineered heavy duty chain drive pulley operating system consisting of metal clutch housing and locking plug containing minimum 6 ribs and inserted at minimum of 2-1/4” into roller tube. Lift torque enhancement provided by Counter Balance System with integrated spring support module. Utilization of adjustment-free continuous qualified T304 stainless steel ball chain with 110 lbs. breaking strength for precise control, smooth operation and ensuring a uniform look. Chain tensioner to be compliant with WCMA safety standard A100.1-2010 and must prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2. Components will be maintenance free from adjustments or lubrication for trouble-free operation.

3. Dual Roller Shades: Universal mount steel brackets with 2 separate solar and room darkening blackout roller shades operating independently of each other.
4. Roller Tube: Circular-shaped aluminum tube extruded from alloy and temper 6063 T-6. 2”outside diameter extruded tube to have a .063” wall thickness (2.5” outside diameter to have a .079” wall thickness). Heavily reinforced with minimum six internal ribs providing additional tensile strength and allows for secure placement of clutch & end plug.
5. Heavy Duty Tube Bearing Plug: Die cast metal and reinforced idler assembly containing spring loaded end plug with positive locking wheel allows for up to 7/8” adjustment and provides for a secure installation and removal of shade. Locking tube bearing plug contains minimum 6 ribs and inserted a minimum of 2-3/8” into roller tube.
6. Bottom Bar: Extruded aluminum weight in a Sealed Pocket Hem Bar, or RB Bottom Bar for fabrics that are not seamable. Bottom bar is for tracking adjustments and provides uniform look.
7. Mounting Hardware: Manufacturer’s standard heavy duty bracket constructed of hardened 1/8” thick steel to support full weight of shade with bracket & screw hole covers to provide uniform look. Integrated leveling device for enhanced level adjustment of overall shade. Locking mechanism on bracket adapter provides for a secure installation and removal of the shade.
8. Fascia: L shape removable aluminum extrusion valance that attaches to brackets and conceals roller shade.
9. Roller Shade Pocket: Extruded aluminum alloy U shape housing for recessed mounting in acoustical tile or drywall ceilings. 5.25” (or 9”) in diameter with aluminum closure mount.
10. Blockout System: Extruded aluminum side channel with concealed mounting brackets. Bottom bar with nylon wool pile to prevent light leakage.
11. Additional Available Options: RB500 Bottom Bar, Reverse Roll, Detachable Spline, Internal Auto Stop Mechanism, Coupled and Banded

2.03 MOTORIZED ROLLER SHADES

A. Product: Hunter Douglas Architectural “RB 500 Motorized Roller Shades”

B. Materials:

1. Fabrics: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, & blackout fabrics providing 0% -14% openness factors. Fabric weights to range between 6.00 oz/sq.yd. – 20.70 oz/sq.yd., containing fiberglass, PVC, polyester, acrylic, vinyl laminates, cotton, & vinyl coatings. Finish selected by architect from manufacturer’s available contract colors.
2. Roller Shade Motors: Design of shade motors is based on the Whisper HDC100RQ and HDC200RQ control system manufactured by Hunter Douglas Contract Window Coverings or Somfy systems.
3. Motors:
   a. Tubular, asynchronous (non-synchronous) motors with a 3 conductor keyed AC power plug at the motor head that can be detached at the motor head assembly directly. Concealed inside roller shade tube. Quiet operation of up to 44dBa within 3’.
   b. Intelligent AC motor 115 VAC, 50-60 Hz, thermally protected, lifetime lubricated, equipped with an internal thermal overload protector. Maximum current draw not to exceed 0.9 amps when operating up to an overall width of 156”, or a maximum current of 1.8 amps when operating 156”+ overall width.
   c. Provide the ability to set limit stop positioning (maximum up/down limits) through 3 clear buttons with internal LED’s.

d. Use motors rated at the same nominal speed for all roller shades in the same room.

e. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of 6Nm when operating up to 156” overall width, and 12Nm when operating 156”+ overall width.

f. Motors must include an embedded Motor Control System without requiring any external motor logic control system outside of the motor assembly unit itself.

4. Keypad/Local User Override:

a. Allow for keypad switch control for up to 24 buttons connected directly to the Whisper RQ motor assembly to allocate for individual and group control, with up to four intermediate stop positions. When utilizing intermediate stop positions, all shades in the same room must be able to perfectly align with each other along those programmed intermediate stops.

b. Connect local wall switches/keypads directly to the motor assembly itself via a low voltage (DC) CAT5/RJ25 cable. A low voltage (DC) splitter is used to connect the keypad to the motor, and to allow for communication/direct connection to adjacent motors in the same network.

c. Controls shall be Master and Subgroup switching for all three elevations, as indicated in Contract Documents.

5. Control Systems:

a. Design of motor control system is based on the Whisper RQ control system manufactured by Hunter Douglas Contract Window Coverings, or equal.

b. Motor Control System:

1) Must be integrated into the motor unit itself. External motor control systems that require “home run” 110v line voltage will not be accepted.

2) Motor Control System must provide bidirectional feedback, allowing for two-way communication between the motor with embedded internal motor control system and it’s point of communication.

3) Motor control system allows for backward compatibility to allow for the add-on of building automation system integration, audio-visual systems, third party light control systems, light sensors, Radio Frequency and Infrared Remote operation, all through means of plugging into the splitter via a low voltage (DC) CAT6/RJ25 plug-in.

4) Allow for up to 100 Whisper RQ Motors to be networked together to allow for master group controlling or integration with third-party light control and building automation systems.

5) Allow for up to four intermediate stop positioning via the keypad/local-user override, or up to 98 intermediate stop positioning if accepting commands via serial input (computer, third party light control systems, or automation systems)

6) Allow for operation of all motors via a computer on the GUI PRO system.

7) Reconfiguration of switch shall not require rewiring of the hardwired line voltage motor power supply wiring, or the low voltage control wiring. Reconfiguration of switch groups shall be accomplished within the motor control device (Whisper RQ with embedded internal motor control system)

c. Operating Features:

1) Group switching with integrated switch control; single faceplate for multiple switch cutouts.

2) Capable of interface with audiovisual control system at rooms wither overhead projectors are located

2.04 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: Glacier Screen HD1005; 2x2 basketweave consisting of 22% polyester, 78% vinyl
   3. Greenguard Gold certified
   4. Silver nano sterilization - protection against bacteria, fungi, microbes and viruses
   5. Thickness: .026 inches
   6. Weight: 14.6 oz/sq. yd.
   7. Roll Width: As indicated on drawings.
   8. Orientation on Shadeband: Up the bolt.
   9. Openness Factor: 5 percent
   10. Color: TBD by Interior Designer

C. Blackout Fabric with Opaque Acrylic Backing: Stain and fade resistant.
   1. Source: Roller-shade manufacturer.
   2. Type: Avila Twilight; PVC free consisting of 37.5% polyester, 62.5% acrylic foam backing
   3. Bacterial Resistance: ASTM G21
   4. Thickness: .02 inches
   5. Weight: 14.5 oz/sq. yd.
   6. Roll Width: As indicated on drawings.
   7. Orientation on Shadeband: Up the bolt.
   8. Features: Washable.
   9. Color: TBD by Architect

D. Only one section of fabric is permitted in room LC230 at north window between column grid lines two and three. No vertical gaps or seams allowed.

2.05 ACCESSORIES

A. Dual Roller Shades: Universal mount steel brackets with 2 separate solar and room darkening blackout roller shades operating independently of each other.

B. Roller Tube: Circular-shaped aluminum tube extruded from alloy and temper 6063 T-6. 2”outside diameter extruded tube to have a .063” wall thickness (2.5” outside diameter to have a .079” wall thickness). Heavily reinforced with minimum six internal ribs providing additional tensile strength and allows for secure placement of clutch & end plug.

C. Heavy Duty Tube Bearing Plug: Die cast metal and reinforced idler assembly containing spring loaded end plug with positive locking wheel allows for up to 7/8” adjustment and provides for a secure installation and removal of shade. Locking tube bearing plug contains minimum 6 ribs and inserted a minimum of 2-3/8” into roller tube.

D. Bottom Bar: Extruded aluminum weight in a Sealed Pocket Hem Bar, or RB Bottom Bar for fabrics that are not seamable. Bottom bar is for tracking adjustments and provides uniform look.

E. Mounting Hardware: Manufacturer’s standard heavy duty bracket constructed of hardened 1/8” thick steel to support full weight of shade with bracket & screw hole covers to provide uniform look. Integrated

leveling device for enhanced level adjustment of overall shade. Locking mechanism on bracket adapter provides for a secure installation and removal of the shade.

F. Fascia: L shape removable aluminum extrusion valance that attaches to brackets and conceals roller shade.

G. Roller Shade Pocket: Extruded aluminum alloy U shape housing for recessed mounting in acoustical tile or drywall ceilings. 5.25” (or 9”) in diameter with aluminum closure mount.

H. Blockout System: Extruded aluminum side channel with concealed mounting brackets. Bottom bar with nylon wool pile to prevent light leakage.

I. Additional Available Options: RB500 Bottom Bar, Reverse Roll, Detachable Spline, Internal Auto Stop Mechanism, Coupled and Banded

2.06 FABRICATION

A. Shade measurements shall be accurate to within + 1/8” or as recommended in writing by manufacturer.

B. Roller-shade fabrication:

1. 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.

2. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

a. 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.

3. Shadeband Fabrication: Fabricate shade bands without battens or seams to extent possible except as follows:

a. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.01 INSPECTION

A. Subcontractor shall be responsible for inspection on site, approval of mounting surfaces, installation conditions and field measurement for this work.

B. Other interacting trades shall receive drawings of shade systems, dimensions, assembly and installation methods from subcontractor upon request.

3.02 INSTALLATION

A. Installation shall comply with manufacturer’s specifications, standards and procedures as detailed on contract drawings.

B. Adequate clearance shall be provided to permit unencumbered operation of shade and hardware.

C. Clean finish installation of dirt and finger marks. Leave work area clean and free of debris.

D. Roller-Shade: Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

E. Electrical Connections: Connect motor-operated roller shades to build electrical system.

3.03 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.04 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

END OF SECTION

SECTION 12 4813
ENTRANCE FLOOR MATS

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Floor Mat and Frame: Support minimum 1500 pound rolling load without permanent deformation or damage.

1.02 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings: Include locations, dimensions, materials, finishes, and installation details.
   2. Product Data: Describe mat and frame construction and finishes.
   3. Samples: 3 inch long tread samples showing available colors.

1.03 QUALITY ASSURANCE

A. Slip Resistance: Minimum coefficient of friction of 0.60, tested to ASTM D 2047.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Arden Architectural Specialties, Inc. (www.ardenarch.com)
   2. Balco, Inc. (www.balcousa.com)
   3. Construction Specialties, Inc. (www.c-sgroup.com)
   4. JL Industries. (www.jlindustries.com)
   5. Pawling Corp. (www.pawling.com)

2.02 COMPONENTS

A. Aluminum Grid Mat: Provide Pedimat AA M2 as manufactured by Construction Specialties.
   1. Treads: Extruded aluminum, individual type joined with extruded aluminum connecting rails
   2. Frame: Square edge aluminum.
   3. Tread Inserts: Exterior carpet.
   4. Depth: 7/16 inch.

B. Frame: Tapered extruded aluminum.

2.03 FINISHES

A. Aluminum:
   1. Anodized, clear anodized.
   2. Apply zinc rich primer to surfaces in contact with concrete.

B. Tread Inserts: Color to be selected from manufacturer's full color range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations.

B. Set surface-mounted frame level, plumb, and aligned.

C. Place mats level without adhesive.

END OF SECTION

SECTION 12 9300
SITE FURNISHINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Bicycle Racks
   2. Site Signage
   3. Benches
   4. Litter and Recycling Receptacles
   5. Bollards
   6. Boot Brush

1.02 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit manufacturer's descriptive data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Bicycle Racks – Acceptable Manufacturer:
   1. Cora Bike Rack, Inc. (www.cora.com)
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Site Signage - Acceptable Manufacturer:
   1. Sa-So (Sargent-Sowell, Inc.) 1185 108th Street, Grand Prairie, TX 75050.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Benches – Acceptable Manufacturer:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Victor Stanley, Inc.; CM-214 6’ bench with Recycled plastic slats.
   2. Columbia Cascade Company- Restoration
   3. Landscape Forms- Plainwell

D. Litter and Recycling Receptacles – Acceptable Manufacturer:
   1. Basis-of Product: Subject to compliance with requirements, provide Victor Stanley, Inc; S-42 Litter and Recycling Receptacle.
   2. Columbia Cascade Company.
   3. Forms+Surfaces.
   4. Landscape Forms.

E. Benches – Acceptable Manufacturer:
   1. Basis-of-Design: Subject to compliance with requirements, provide Landscape Forms, Annapolis standard Bollard.
   2. Creative Pipe, Inc.
   3. Urban Accessories, Inc.

F. Boot Brush – Acceptable Manufacturer:
   1. Basis-of Product: Subject to compliance with requirements, provide Rhino-Bilt, Inc.

2.02 MATERIALS

A. Multiple unit bike rack.

1. Manufacturer: Cora Bike Rack, Inc. - www.cora.com

a). Cora Expo 'W' Series Bicycle Rack – Expo 7510

b). Length for 10 bike capacity, double-sided access

c). Surface mount, two bolt fastening system with 1/2 inch clearance holes.

d). Finishes: Powder Coated carbon steel: Color to be selected from manufacturer's full color range.

B. Sign Materials:

1. Steel Sheets: ASTM A 591, Class C, galvanized-bonderized, 0.0478" (18 gage) thickness, with baked-on primer and synthetic enamel finish.

2. Aluminum Sheets: ASTM B 209, alloy 6061 T6, degreased and etched, 0.080" thickness. Sign faces shall be fully reflectorized with material conforming to Mil. Spec. MIL-R-13689A.

C. Benches

1. Frame: Cast iron.

2. Seat and Back:

a. Material:

1). Recycled Plastic Planks: Evenly spaced, parallel. Grey

2). Seat Height: 17-3/4".

3). Seat Surface Shape: Contoured or dished.

4). Overall Width: 6 feet.

5). Overall Depth: 22-1/4".

6). Arms: each end.

a. Arm Material: Match frame.

3. Warranty: 10 years.

4. Seating Configuration: Straight shape.

D. Litter and Recycling Receptacles:

1. Steel Facing Surrounds: Evenly patterned, parallel flat steel straps, bars, or tubular shapes.

2. Support Frames: Steel; welded.

3. Trash Receptacles:

a. Receptacle Shape and Form: Round cylinder; with opening for depositing trash in lid or top.

b. Lids and Tops: Matching facing panels secured by cable or chain, hinged, swiveled, or permanently secured.

c. Description: Flat rim ring lid with center opening.

d. Receptacle Height: 38-5/8".

e. Overall Width: 19".

f. Inner Container: Rigid plastic container with drain holes lift-out handles; designed to be removable and reusable.

g. Disposable Liners: Provide receptacle designed to accommodate disposable liners.

h. Capacity: Not less than 36 gal..

i. Service Access: Removable lid or top; inner container and disposable liner lift or slide-out for emptying

j. HDPE Color: Black.

k. Graphics: Surface-applied copy, content, and style according to manufacturer's standard.

l. Copy: Litter and Recycle.

E. Bollards:
1. Structural steel tube, ASTM A 500, grade B.
2. Bollard Top: Aluminum Casting
3. Plastic Sleeve: Low density polyethylene, .22” thick, 26.625 inches long, textured
4. Style: Manufacturer's standard Ornamental cap.
5. Overall Height: 33”.
6. Overall Width: 6” diameter.
7. Installation Method: Embedded.
8. Color: Black.

2.03 MANUFACTURED UNITS

A. Reserved Parking Signs: Baked enamel on 18 gage steel.
B. Traffic Signs:
1. ONE WAY Signs: Reflective sheeting on 0.080" aluminum.
2. ONE WAY - DO NOT ENTER Signs: Reflective sheeting on 0.080" aluminum.

2.04 ACCESSORIES

A. Bolts, Nuts, Washers, and Clamps: Cadmium or galvanized steel. Bolts shall be a minimum of 5/16" in diameter. Clamps shall be two-piece assemblies of at last 14 gage steel or shall be an adjustable steel strap bracket.
B. Posts: Standard galvanized steel pipe 2-3/8" in diameter and weighing not less than 2 lbs. per linear foot.
C. Concrete Materials: Specified in Section 03 3000.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install furnishings in accordance with manufacturer's written instructions and recommendations
B. Set plumb, level, rigid and aligned.

END OF SECTION

SECTION 13 3419
METAL BUILDING SYSTEMS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures.
   1. Shop Drawings:
      a. Include for structural components:
         1) Plans, elevations, and sections showing location of components.
         2) Details showing anchoring, fastening, and interface with other work.
      b. Include for panels:
         1) Configuration of panels, trim members, and closures.
         2) Assembly of system components, including typical and special conditions.
   2. Product Data: Include description of system components and verify compliance with specified requirements.
   3. Samples: Panel samples in profile proposed, showing available colors.

1.02 QUALITY ASSURANCE

A. Designer Qualifications: Professional Structural Engineer licensed in state in which project is located, with minimum 5 years experience in work of this section.
B. Installer Qualifications: Minimum 5 years documented experience in work of this section.
C. Welder Qualifications: AWS D1.1.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store steel above ground on platforms, skids, or other supports; separate with wooden separators.
B. Protect steel from corrosion.
C. Prevent damage to prime coat; use wooden protectors to prevent damage from chain or cable cinches.
D. Protect panels and trim from contact with materials that could cause staining or discoloration of finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Preferred Manufacturers:
   1. Building Specialists Group Inc., Contact: Jay Swogger. 1401 Meacham Blvd, Fort Worth, TX 76106. Phone: 817-821-4393. Email: buildingspecial@sbcglobal.net
   2. Brazos Metal Building Systems, Contact: 5530 W Hwy 377, Tolar, TX 76476. Phone: 817-573-2400 Email: sales@brazosmetal.net
B. Acceptable Manufacturers:
   1. Butler Manufacturing Co. (www.butlermfg.com)
   2. Ceco Building Systems. (www.cecobuildings.com)
   3. Muller, Inc. (www.mullerinc.com)
   4. Red Dot Buildings (www.reddotbuildings.com)
   5. Star Building Systems. (www.starbuildings.com)

2.02 MATERIALS

A. Framing:
   1. Primary components: ASTM A36.
   2. Secondary components: ASTM A1008.
   3. Fasteners:
      a. Primary framing: ASTM A325.
      b. Secondary framing: ASTM A307.
   4. Primer paint: SSPC Paint 15, Type 1, red oxide.

B. Metal Wall and Roof Panels, Gutters, Downspouts, Trim, and Closures: ASTM A653/A653M galvanized steel, Structural Quality, G90 coating class.

C. Panel Closures: Die cut compressible filler to fit panel configuration.

D. Fasteners: Stainless or plated steel, type as required; head color to match panels where exposed, with nylon or neoprene washers.

E. Skylights: Manufacturer's standard.

F. Insulation: ASTM C665, vinyl faced fiberglass blankets, 6 inches thick, R-value of 22, maximum flame spread/smoke developed rating of 25/50 where exposed.

2.03 FABRICATION

A. Steel Framing Components:
   1. Fabricate structural steel in accordance with AISC and AISI Specifications.
   2. Welding: AWS D1.1.

B. Wall Panels:
   1. Galvanized steel sheet, minimum 26 gage core steel, roll formed.
   2. 36 inches wide x 1-1/2 inches high, major corrugations at 12 inches on center and minor corrugations at 4 inches on center, interlocking edges.
   3. Single piece from base to top of wall.
   4. Trim members: Form from same material and gage and with same finish as panels.

C. Roof Panels:
   1. Galvanized steel sheet, minimum 24 gage core steel, roll formed.
   2. 24 inches wide x 3 inches high, interlocking edges.
   3. Ridge assembly designed to allow thermal movement.
   4. Factory punched at ends to match holes in eave member.
   5. Designed to fasten to supports by means of thermally responsive panel clips.
   6. Single piece from ridge to eave.
   7. Trim members: Form from same material and gage and with same finish as panels.
   8. Thermal spacers: As required for insulation system.

D. Gutters and Downspouts:
   1. Galvanized steel sheet, minimum 26 gage core steel, roll formed.
   2. Fabricate end caps, downspout outlets and headers, straps, brackets, and downspout strainers in profile to suit gutters and downspouts.

2.04 FINISHES

A. Framing Members: Shop paint steel surfaces except surfaces to be welded and contact surfaces of high strength friction type bolted connections.
   1. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
   2. Application: One coat; follow coating manufacturer's instructions.
   3. Minimum dry film thickness: 2.0 mils.

B. Panels and Trim: AAMA 2605, fluoropolymer coating containing minimum 70 percent PVDF resins, color to be selected from manufacturer's full color range.

PART 3 - EXECUTION

3.01 ERECTION OF FRAMING SYSTEM

A. Install in accordance with AISC and AISI Specifications, manufacturer's written instructions and recommendations.

B. Fit members square against abutting components.

C. Position members plumb, square, and level.

D. Temporarily brace members until permanently fastened.

E. Do not splice load bearing members.

F. Align and adjust various members forming parts of a complete frame or structure after assembly but before fastening.

G. Rigidly connect members using welds or bolts.

H. Installation Tolerances:
   1. Maximum variation from location: Plus or minus 1/4 inch.
   2. Maximum variation from plane: 1/4 inch in 10 feet.

3.02 INSTALLATION OF METAL PANELS

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install aligned, level, and plumb.

C. Fasten panels using concealed panel clips. Exposed fasteners permitted on trim members only.

D. Locate panel joints over supports.

E. Lap end joints 4 inches minimum.

F. Install trim to maintain visual continuity of system.

G. Install joint sealers and gaskets to prevent water penetration.

H. Flash penetrations through roofing with metal trim to match panels:
   1. Lap flashings over roof panels 12 inches minimum on all sides and seal with double bead of joint sealer.
   2. Install metal draw band and joint sealer at top of pipe penetrations.
   3. Install water diverter at uphill side of square and rectangular penetrations.

3.03 INSTALLATION OF GUTTERS AND DOWNSPOUTS

A. Gutters: Secure with straps spaced maximum 36 inches on center and within 6 inches of ends.

B. Downspouts:

1. Secure with straps spaced maximum 8 feet on center and within 2 feet of ends and elbows.
2. Flash downspouts minimum 3 inches into gutters and fasten.
3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.

3.04 ADJUSTING

A. After erection of structural steel, touch up bolt heads and nuts, field welds, and abrasions with same primer used in shop.

B. Touch up field cuts, scratches, and abrasions on exposed panel surfaces and trim to match factory finish.

END OF SECTION

SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal hanger-shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe-positioning systems.
10. Equipment supports.

B. Related Requirements:

1. Division 05 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 22 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.
4. Division 21 “Water-Based Fire-Suppression Systems” for pipe hangards for fire-suppression piping.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Steel pipe hangars and supports.
2. Fiberglass pipe hangars.
3. Thermal-hangar shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for Components.
2. Metal framing systems. Include Product Data for Components.
3. Fiberglass strut systems. Include Product Data for Components.
4. Pipe stands. Include Product Data for Components.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to the following:
1. 2015 ASME Boiler and Pressure Vessel Code, Section IX.
2. AWSD1.1, “Structural Welding Code-Steel.”
3. AWSD1.2, “Structural Welding Code-Aluminum.”
4. AWSD1.4, “Structural Welding Code-Reinforcing Steel.”

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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. B-line; Eaton, Electrical Sector.
b. Flex-Strut Inc.
c. Gregory Industries.
d. Haydon Corporation.
e. Unistrut; Atkore International.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted stainless-steel, Type 304 channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Coatings: Manufacturer’s standard finish unless bare metals are indicated.
9. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 THERMAL HANGER-SHIELD INSERTS

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. CADDY; nVent.
2. Carpenter & Paterson, Inc.
3. National Pipe Hanger Corporation.
4. Pipe Shields Inc.
5. Piping Technology & Products, Inc.
6. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Cold Piping: Water-repellant treated, ASTM C 553, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellant treated, ASTM C 553, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.06 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: 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. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.
d. Simpson Strong-Tie Co., Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: 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. B-line; Eaton, Electrical Sector.
b. Empire Tool and Manufacturing Co., Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
e. MKT Fastening, LLC.

2.07 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two galvanized steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
5. Pipe Supports: Clevis hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.08 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.09 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.10 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M).

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

END OF SECTION 220529

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.

2. Material and Thickness: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.02 WARNING SIGNS AND LABELS

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. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

F. Fasteners: Stainless-steel rivets or self-tapping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

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. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to **cover full** circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.04 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.

B. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch, or stainless steel, 0.025-inch, minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.05 WARNING TAGS

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. Brady Corporation.
2. Brimar Industries, Inc.
3. Champion America.
4. Craftmark Pipe Markers.
5. emedco.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of **50 feet** along each run. Reduce intervals to **25 feet** in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Colors:

    a. Cold Water: Natural.

b. Hot Water: Natural.
c. Low-Pressure Compressed Air: Safety blue.
d. High-Pressure Compressed Air: Safety blue.

2. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.
c. Low-Pressure Compressed Air: White.
d. High-Pressure Compressed Air: White.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.
9. Condensate drain piping

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. Knauf Insulation.
    c. Manson Insulation Inc.
    d. Owens Corning.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA.
    b. Armacell LLC.
    c. Foster Brand; H. B. Fuller Construction Products.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Childers Brand; H. B. Fuller Construction Products.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.

2.03 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.04 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.05 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.06 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.
   b. P.I.C. Plastics, Inc.
   c. Proto Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.08 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions.

Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.09 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch** thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch**.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
   a. Polyolefin: **3/4 inch** thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inches** thick.

H. Floor Drains, Traps, and Sanitary Drain Piping within **10 Feet** of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch** thick.

I. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be[**one of**] the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: **1 inch** thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. PVC 20 mils thick.
2. Stainless Steel, Type 316, Smooth 2B Finish: 0.010 inch thick.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Encasement for piping.
4. Transition fittings.
5. Dielectric fittings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.03 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. Sustainable Design Submittals:

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and [ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems.
    c. Mueller Industries, Inc.
    d. NIBCO INC.
    e. Viega LLC.

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems.
    c. NIBCO INC.
    d. Victaulic Company.

2. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Copper-Tube, Extruded-Tee Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. T-DRILL Industries Inc.

2. Description: Tee formed in copper tube according to ASTM F 2014.

J. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Anvil International.
b. Grinnell G-Fire by Johnson Controls Company.
c. Shurjoint; a part of Aalberts Integrated piping Systems.
d. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig.

2.03 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.

1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.04 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.05 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.06 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

D. Plastic-to-Metal Transition Fittings:

a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:

a. CPVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

2.07 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Standard: ASSE 1079.

2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: **300 psig at 225 deg F.**
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

N. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.05 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

H. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.08 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, ASTM B 88, Type L; cast or wrought-copper, solder-joint fittings; and soldered joints.
3. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.
5. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
6. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
7. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
4. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water-hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
18. Specialty valves.
19. Flexible connectors.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
4. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

PART 2 - PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Cash Acme, A Division of Reliance Worldwide Corporation.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Cash Acme, A Division of Reliance Worldwide Corporation.
    c. WATTS.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. FEBCO; A WATTS Brand.
    c. WATTS.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: **5 psig** maximum, through middle third of flow range.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1035.
3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.02 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Body: Bronze.
5. End Connections: Solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. FEBCO; A WATTS Brand.

d. WATTS.
e. Zurn Industries, LLC.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:

a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

D. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. WATTS.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

F. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. WATTS.
c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

G. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. FEBCO; A WATTS Brand.
c. WATTS.
d. Zurn Industries, LLC.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.03 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Cash Acme, A Division of Reliance Worldwide Corporation.
c. WATTS.
d. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Flomatic Corporation.
c. WATTS.
d. Zurn Industries, LLC.

2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

C. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. NIBCO INC.
d. TAC Americas.
e. Taco, Inc.
f. WATTS.

2. Type: Ball valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Corporation.
    d. NIBCO INC.
    e. Schneider Electric USA, Inc.
    f. WATTS.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

E. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

F. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Crane; a Crane Co. brand.
    c. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.04 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company; a Division of Morris Group International.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. Leonard Valve Company.
    d. POWERS; A WATTS Brand.
    e. Symmons Industries, Inc.
    f. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.
9. Piping Finish: Copper.
10. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

B. Manifold, Thermostatic, Water Mixing-Valve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Leonard Valve Company.
    b. POWERS; A WATTS Brand.
    c. Symmons Industries, Inc.

2. Description: Factory-fabricated, exposed-mounted, thermostatically controlled, water mixing-valve assembly in two-valve parallel arrangement.
3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
4. Small-Flow Parallel: Thermostatic, water mixing valve.
5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
7. Pressure Rating: 125 psig minimum unless otherwise indicated.
8. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company; a Division of Morris Group International.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.
    d. POWERS; A WATTS Brand.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1016, ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.05 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron[with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and] for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.033 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
    c. Strainers NPS 5 and Larger: 0.125 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.06 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company; a Division of Morris Group International.
    b. Guy Gray, IPS Corporation.
    c. LSP Products Group.
    d. Oatey.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Symmons Industries, Inc.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: **NPS 2** standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. LSP Products Group.
    b. Oatey.
    c. Sioux Chief Manufacturing Company, Inc.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.07 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

2.08 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS.
    e. Woodford Manufacturing Company.
    f. Zurn Industries, LLC.

2. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Rough bronze.
12. Operating Keys(s): One with each wall hydrant.

2.09 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. MIFAB, Inc.
    c. WATTS.
    d. Woodford Manufacturing Company.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:

    a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

11. Operating Key(s): One with each loose-key-operation wall hydrant.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.

4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Jay R. Smith Mfg Co; a division of Morris Group International.
   c. Josam Company.
   d. MIFAB, Inc.
   e. WATTS.
   f. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. WATTS.
   e. Zurn Industries, LLC.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.13 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Sioux Chief Manufacturing Company, Inc.
   b. Zurn Industries, LLC.

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Recessed mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Vacuum Breaker: ASSE 1001.
7. Size Outlets: NPS ½.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves[**and bypass with globe valve**]. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

J. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

K. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

L. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

M. Install water-hammer arresters in water piping according to PDI-WH 201.

N. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

O. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

P. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

Q. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.02 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.
7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
8. Double-check, detector-assembly backflow preventers.
9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water mixing-valve assemblies.
13. Photographic-process, thermostatic, water mixing-valve assemblies.
14. Primary water tempering valves.

15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221123

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.
2. Horizontally mounted, in-line, close-coupled centrifugal pumps.
3. Vertically mounted, in-line, close-coupled centrifugal pumps.

B. Related Sections include the following:

1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.

1.03 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Marshall Engineered Products Co.
5. Paco Pumps, Inc.
6. Thrush Company, Inc.
7. Weinman Div.; Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics:

2.02 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett; a Xylem brand.
3. Marshall Engineered Products Co.
4. Paco Pumps, Inc.
5. Thrush Co. Inc.
6. Weinman Div.; Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.

4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

2.03 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Bell & Gossett; a Xylem brand.
3. Grundfos Pumps Corp.
4. Marshall Engineered Products Co.
5. PACO Pumps; Grundfos Pumps Corporation, USA.
6. Thrush Co. Inc.
7. Weinman Division.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.

C. Pump Construction:

1. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Stainless-steel shaft, with copper-alloy shaft sleeve.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.

D. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.

2.04 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.05 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120-V ac.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.

D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.

E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using elastomeric pads. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Minimum Deflection: 1/4 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

F. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

G. Install pressure switches in water supply piping.

H. Install thermostats in hot-water return piping.

I. Install timers on wall in engineer's office.

J. Install time-delay relays in piping between water heaters and hot-water storage tanks.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
    b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    c. Vertically mounted, in-line, close-coupled centrifugal pumps.
    d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.

1. Comply with requirements for valves specified in the following Sections:

    a. Section 220523.12 "Ball Valves for Plumbing Piping."
    b. Section 220523.13 "Butterfly Valves for Plumbing Piping."
    c. Section 220523.14 "Check Valves for Plumbing Piping."
    d. Section 220523.15 "Gate Valves for Plumbing Piping."

2. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
3. Install pressure gage **and snubber** at suction of each pump and pressure gage **and snubber** at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Connect pressure switches, thermostats, time-delay relays, and timers to pumps that they control.

F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.04 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

A. **Engage a factory-authorized service representative to perform** startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set **pressure switches, thermostats, timers, and time-delay relays** for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

a. Verify bearing lubrication.
b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.06 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 221316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Requirements:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.04 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify [Architect] [Construction Manager] [Owner] no fewer than [two] <Insert number> days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without [Architect's] [Construction Manager's] [Owner's] written permission.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 150 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, [Service] [and] [Extra Heavy] class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage fittings.

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. Conine Manufacturing Co., Inc.
b. SE Sovent.

C. CISPI, Hubless-Piping Couplings:

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. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Dallas Specialty & Mfg. Co.

d. Fernco Inc.
e. Ideal Tridon
f. Josam Company.
g. MIFAB, Inc.
h. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

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. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Clamp-All Corp.
d. Dallas Specialty & Mfg. Co.
e. Ideal Tridon
f. MIFAB, Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

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. Charlotte Pipe and Foundry Company.
b. Ideal Tridon
c. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.05 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. [Galvanized-]Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. [Galvanized-]Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. [Galvanized-]Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

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. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
b. Shurjoint; a part of Aalberts Integrated piping Systems.
c. Smith-Cooper International.
d. Victaulic Company.

2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
3. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

2.06 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.07 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.

D. Ductile-Iron, Grooved-End Pipe Appurtenances:

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. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
b. Shurjoint; a part of Aalberts Integrated piping Systems.
c. Smith-Cooper International.
d. Victaulic Company.

2. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
3. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.08 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.09 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.10 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.11 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company, LLC; a division of MCP Industries.
4) Plastic Oddities.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

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) Apollo Valves; a part of Aalberts Integrated Piping Systems.
2) Cascade Waterworks Mfg. Co.
3) EBAA Iron, Inc.
4) Ford Meter Box Company, Inc. (The).
5) JCM Industries, Inc.

6) Romac Industries, Inc.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: [Manufacturer's standard] [Carbon steel] [Stainless steel] [Ductile iron] [Malleable iron].
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [250 psig (1725 kPa)] <Insert pressure>.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [175 psig (1200 kPa)] [300 psig (2070 kPa)] <Insert pressure>.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: [150 psig (1035 kPa)] <Insert pressure>.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

4. Dielectric Nipples:

a. Description:

1) Standard: IAPMO PS 66.
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

2.12 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet.

D. Color: Black.

PART 3 - EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

R. Install aboveground ABS piping according to ASTM D 2661.

S. Install aboveground PVC piping according to ASTM D 2665.

T. Install underground PVC piping according to ASTM D 2321.

U. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

V. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

X. Install force mains at elevations indicated.

Y. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

AA. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: [Unshielded] [Shielded], nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

    a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.05 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.[Use normally closed type unless otherwise indicated.]
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install [carbon-steel] <Insert material> pipe hangers for horizontal piping in noncorrosive environments.
2. Install [stainless-steel] [fiberglass] pipe hangers for horizontal piping in corrosive environments.
3. Install [carbon-steel] <Insert material> pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting[, valve,] and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.

2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet.

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet.

N. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

O. Install supports for vertical PVC piping every 48 inches.

P. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves [with cleanout cover flush with floor] [in pit with pit cover flush with floor] <Insert description>.
6. Comply with requirements for [backwater valves] [cleanouts] [and] [drains] specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours.
    b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
.
3. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.

4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:

1. Soft copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.

4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:

1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION

SECTION 223300
ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Commercial, electric, domestic-water booster heaters.
2. Commercial, electric, storage, domestic-water heaters.
3. Commercial, light-duty, storage, electric, domestic-water heaters.
4. Residential, small-capacity, electric, domestic-water heaters.
5. Residential, collector-to-tank, solar, electric, domestic-water heaters.
6. Residential, collector-to-tank-coil, solar, electric, domestic-water heaters.
7. Residential, electric, storage, domestic-water heaters.
8. Residential, tabletop, electric, domestic-water heaters.
9. Flow-control, electric, tankless, domestic-water heaters.
10. Thermostat-control, electric, tankless, domestic-water heaters.
11. Domestic-water heater accessories.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.04 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial residential and tankless, electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.08 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

   a. Commercial, Electric, Domestic-Water Booster Heaters:

1) Controls and Other Components: Five years.

b. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Five ears.

c. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1) Storage Tank: Five] years.
2) Controls and Other Components: Three years.

d. Residential, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: 10 years.
2) Controls and Other Components: Three] years.

e. Electric, Tankless, Domestic-Water Heaters: Five year(s).
f. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.01 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Domestic-Water Booster Heaters:

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. A. O. Smith Corporation.
b. Lochinvar, LLC.
c. Rheem Manufacturing Company.

2. Standard: UL 1453.
3. Tank Construction: Corrosion-resistant metal or steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
c. Insulation: Comply with ASHRAE/IESNA 90.1.
d. Jacket: Rectangular shaped, with stainless-steel front panel, unless otherwise indicated.
e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.

1) Option: Booster heaters with total of 9 kW or less may have two or three elements.

f. Temperature Control: Adjustable thermostat, to setting of at least 180 deg F.
g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting

less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

i. Gages: Combination temperature-and-pressure type or separate thermometer and pressure gage.

5. Special Requirements: NSF 5 construction with brackets for undercounter legs for floor installation.

B. Commercial, Electric, Storage, Domestic-Water Heaters:

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. A. O. Smith Corporation.
b. Bradford White Corporation.
c. Lochinvar, LLC.
d. PVI; A WATTS Brand.
e. Rheem Manufacturing Company.

2. Standard: UL 1453.
3. Storage-Tank Construction: ASME-code, steel vertical arrangement.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
c. Insulation: Comply with ASHRAE/IESNA 90.1.
d. Jacket: Steel with enameled finish.
e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
f. Temperature Control: Adjustable thermostat.
g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

C. Residential, Electric, Storage, Domestic-Water Heaters:

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. A. O. Smith Corporation.
b. American Water Heaters.
c. Bradford White Corporation.
d. Lochinvar, LLC.
e. Rheem Manufacturing Company.

2. Standard: UL 174.
3. Storage-Tank Construction: Steel.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: ASSE 1005.
    d. Insulation: Comply with ASHRAE 90.2.
    e. Jacket: Steel, cylindrical, with enameled finish.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Heating Elements: Two; electric, screw-in immersion type; wired for nonsimultaneous operation unless otherwise indicated. Limited to 12 kW total.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Control: High-temperature-limit cutoff device or system.
    j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.02 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

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. Chronomite Laboratories, Inc; a division of Morris Group International.
    b. Eemax, Inc.; a Rheem brand.
    c. Stiebel Eltron, Inc.

2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

    a. Connections: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Heating Element: Resistance heating system.
    d. Temperature Control: Flow-control fitting.
    e. Safety Control: High-temperature-limit cutoff device or system.
    f. Jacket: Aluminum or steel with enameled finish or plastic.

4. Support: Bracket for wall mounting.

2.03 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

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. A. O. Smith Corporation.
    b. AMTROL, Inc.

c. Flexcon Industries.
d. Honeywell International Inc.
e. Pentair Pump Group.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: 4 gal. minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

G. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

H. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.04 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters on floor on water-heater stand on floor or on domestic-water heater mounting bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters[at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

D. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

E. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

I. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

K. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

L. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

M. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

N. Fill electric, domestic-water heaters with water.

O. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION

SECTION 23 05 00
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Not all listed materials and systems may be utilized for this project. Use applicable items, as required

B. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. GENERAL MECHANICAL SUBMITTAL REQUIREMENTS

1. In addition to submittal procedures indicated in other sections of this specification, all Division 23 items shall be submitted as one complete set, tabbed and indexed with all equipment and systems properly and clearly identified per project document designations (partial submittals will not be accepted without the written permission of the Engineer). All capacities, standard accessories, options and characteristics shall be clearly and individually identified. Any deviations from the specified systems and equipment shall be clearly identified and accompanied by descriptions, explanations, drawings and calculations, etc. to support their use, indicating specifically how the submitted items will meet requirements of the original design specifications. The Engineer shall have sole discretion, without recourse, as to the determination of what items are deemed suitable for approval. Alternative submittals/substitutions: If re-design of the building and/or systems is required to accommodate the proposed alternative equipment/systems, such re-design shall be performed by the A/E of record, and paid for (on an hourly basis, plus expenses) by the contractor requesting the substitution. Submittals not meeting these requirements are subject to return without notice or review.

B. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical

services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. Motor starters and controls shall be furnished with all mechanical equipment and systems, unless otherwise approved. Exception: starters that are to be furnished as part of a motor control center (mcc) shall be coordinated with, and furnished by electrical.

E. All control wiring shall be installed in EMT conduit (or other approved raceway) as per division 16, and NEC requirements, unless otherwise approved. Exception: properly rated cable (ceiling plenum, etc.) May be installed in accessible, concealed spaces, as directed in other sections of this specification.

F. Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance with its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the project site. Locations for materials or equipment requiring an exact fit shall be field measured. Rotating equipment, piping and duct system shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems without cost to the Owner.

G. Some mechanical equipment sizes indicated on the Drawings are based on a particular manufacturer. It is the responsibility of the Contractor to verify that the equipment he proposes to furnish will fit in the space indicated on the Drawings. Refer to Architectural and Structural Drawings for building dimensions. Equipment furnished by the Owner shall be coordinated with equipment furnished and installed under this section and other sections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

D. Where the mechanical drawings indicate (diagrammatically or otherwise) the work intended and the functions to be performed, even though some minor details are not shown, the Contractor shall furnish all equipment, material (other than Owner furnished items), and labor to complete the installation, and accomplish all indicated functions of the mechanical installation. Further, the Contractor shall be responsible for taking the necessary actions to ensure that all mechanical work is coordinated and compatible with architectural, plumbing, electrical and structural plans. In the event of conflict between the plans and the enforcing code authority, the latter shall rule. Any modification resulting there from shall be made without additional cost to the Owner or Engineer. The contractor shall report such

modifications to the Architect in writing and secure approval before proceeding. Where a conflict between the construction drawings and specifications occur the greater quantity and/or greater quality shall be used.

E. Maintain "As-Built" Drawing to be included with the O & M Manuals. Maintain a set of "Blue-Line Prints and indicate changes and diagrams of those portions of work in which actual construction is significantly at variance with the Contract Drawings. Mark the Drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, drawings clearly indicating locations of all devices, equipment and other pertinent items, as installed. Include invert elevation or buried depth of piping. Upon completion of the project, submit all materials to the Owner, after verifying all the above data is shown correctly.

F. Perform work to meet or exceed the requirements of the International Building Code, International Mechanical Code, International Plumbing Code and other applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction. Resolve any code violation discovered in the Contract Documents with the Engineer prior to award of the Contract. After award of the Contract, make any corrections or additions necessary for compliance with applicable codes at no additional cost to the Owner.

G. Obtain and pay for all permits, licenses and inspections as required by law for the completion of the work. Comply with the requirements of the applicable utility companies serving this project. Make all arrangements with the utility companies for proper coordination of the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.04 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. JCM Industries.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.

2.05 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Victaulic Co. of America.

2.06 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.07 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.08 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Where possible one piece escutcheons shall be used.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.09 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 DRAIN PANS

A. Description: Aluminum or stainless steel formed or welded construction, sized to accommodate the equipment the pan is intended to protect. All equipment (i.e. water heaters, air handlers, pumps, etc.) that are required by code or as indicated on the construction documents shall be provided with a drain pan with the associated copper drain pipe routed to a code compliant receptor.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved prior to installation.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel, and lighting fixture removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Installation shall comply with roofing system warranty requirements.
      1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

Q. Verify final equipment locations for roughing-in.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install drain pans under equipment in such a manner that there is sufficient fall for the water to drain if an overflow/leak condition occurs. The contractor is responsible for coordinating the size and equipment installation for a drain pan and piping system that meets code and functionality requirements.

3.05 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Unless otherwise indicated, where “bright” ductwork, or other piping, etc. systems are visible to the occupied space through grilles, etc., they shall be painted with “flat” black paint, as required.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.08 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.09 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment supports.

1.03 PERFORMANCE REQUIREMENTS.

A. Delegated Design: Design equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 ACTION SUBMITTALS

A. Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents. Deviation from Contract Documents must be approved by engineer prior to submittal.

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

C. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.

2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.06 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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. Cooper B-Line, Inc.

b. Flex-Strut Inc.

c. Thomas & Betts Corporation.

d. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Electroplated zinc.

2.02 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.03 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.04 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.02 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.03 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.04 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.05 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Use hangers and supports with galvanized metallic coatings for equipment that will not have field-applied finish.

C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

D. Use carbon-steel supports and metal framing systems and attachments for general service applications.

E. Building Attachments: Unless otherwise indicated and except as specified in system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

F. Spring Hangers and Supports: Unless otherwise indicated and except as specified in system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

G. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

H. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Duct labels.
3. Stencils.

B. Not all pipe/ductwork types or equipment types may be used on this project. Use the applicable colors and identification tags for equipment provided.

1.03 ACTION SUBMITTALS

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

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.02 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean equipment and duct surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 DUCT LABEL INSTALLATION

A. Stenciled Duct Label: Stenciled labels, showing service and flow direction.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Certified TAB reports.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1.05 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

B. Certify TAB field data reports and perform the following:

C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in certifying organization standards and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

3.06 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record

observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

B. Measure, adjust, and record the following data for each refrigerant coil:

3.09 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

3.010 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

B. Final Report Contents: In addition to certified field-report data, include the following:

C. General Report Data: In addition to form titles and entries, include the following data:

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches.

j. Number, make, and size of belts.

k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.

    b. Horsepower and rpm.

    c. Volts, phase, and hertz.

    d. Full-load amperage and service factor.

    e. Sheave make, size in inches, and bore.

    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm.

    b. Total system static pressure in inches wg.

    c. Fan rpm.

    d. Discharge static pressure in inches wg.

    e. Filter static-pressure differential in inches wg.

    f. Preheat-coil static-pressure differential in inches wg.

    g. Cooling-coil static-pressure differential in inches wg.

    h. Heating-coil static-pressure differential in inches wg.

    i. Outdoor airflow in cfm.

    j. Return airflow in cfm.

    k. Outdoor-air damper position.

    l. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.

    b. Location.

    c. Coil type.

    d. Number of rows.

    e. Fin spacing in fins per inch o.c.

    f. Make and model number.

    g. Face area in sq. ft..

    h. Tube size in NPS.

i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

h. Refrigerant expansion valve and refrigerant types.

i. Refrigerant suction pressure in psig.

j. Refrigerant suction temperature in deg F.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.

b. Location.

c. Coil identification.

d. Capacity in Btu/h.

e. Number of stages.

f. Connected volts, phase, and hertz.

g. Rated amperage.

h. Air flow rate in cfm.

i. Face area in sq. ft..

j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.

b. Air flow rate in cfm.

c. Air velocity in fpm.

d. Entering-air temperature in deg F.

e. Leaving-air temperature in deg F.

f. Voltage at each connection.

g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

I. Round, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.

    b. Location and zone.

    c. Traverse air temperature in deg F.

    d. Duct static pressure in inches wg.

    e. Duct size in inches.

    f. Duct area in sq. ft..

    g. Indicated air flow rate in cfm.

    h. Indicated velocity in fpm.

    i. Actual air flow rate in cfm.

    j. Actual average velocity in fpm.

    k. Barometric pressure in psig.

J. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.

    b. Serial number.

    c. Application.

    d. Dates of use.

    e. Dates of calibration.

3.011 ADDITIONAL TESTS

A. Within 120 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct liners.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application at linkages of control devices.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

A. Schedule insulation application with other trades.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.

b. Johns Manville; Microlite.

c. Knauf Insulation; Friendly Feel Duct Wrap.

d. Manson Insulation Inc.; Alley Wrap.

e. Owens Corning; SOFTR All-Service Duct Wrap.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
   b. Eagle Bridges - Marathon Industries; 501.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
   d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.04 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.05 SECUREMENTS

A. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.

3) Midwest Fasteners, Inc.; WA-150.

4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.06 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.07 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round, supply and return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, round, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, round, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.

D. Concealed, rectangular, air duct insulation shall be the following:

1. Comply with requirements in Section 233113 "Metal Ducts".

E. Concealed, air plenum insulation shall be the following:

1. Comply with requirements in Section 233113 "Metal Ducts".

F. Exposed, round, air duct insulation shall be the following:

1. Comply with requirements in Section 233113 "Metal Ducts".

G. Concealed or exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board tested and rated for grease duct usage per ASTM E 2336; thickness as required to achieve 2-hour fire rating.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.03 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Refrigerant piping and insulation materials.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

D. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

E. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.08 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.09 COORDINATION

A. Coordinate size and location of roof curbs, piping supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Coordinate sizes and locations of supports, hangers, and insulation shields.

C. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.010 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.02 VALVES AND SPECIALTIES

A. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

B. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

C. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Socket.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.

6. Working Pressure Rating: 400 psig (2760 kPa).

7. Maximum Operating Temperature: 240 deg F (116 deg C).

2.03 INSULATION MATERIALS

A. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.04 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide 1-inch-thick insulation form one of the following:

a. Aeroflex USA, Inc.; Aeroseal.

b. Armacell LLC; Armaflex 520 Adhesive.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.

d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.

2. DuPont Company; Fluorochemicals Div.

3. Honeywell, Inc.; Genetron Refrigerants.

4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type L ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

3.02 VALVE AND SPECIALTY APPLICATIONS

A. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

B. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

C. Provide solenoid valve as required by equipment manufacturer.

3.03 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

O. When brazing remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

E. Flexible Elastomeric Thermal Insulation Installed Outdoors: Elastomeric thermal insulation installed outdoors shall have two coats of UV rated paint applied to exposed surface.

3.06 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.

C. Support multifloor vertical runs at least at each floor.

D. Provide high density insulation at all support points matching the R value of the specified insulation.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.08 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

3.09 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open compressor suction and discharge valves.

2. Open refrigerant valves except bypass valves that are used for other purposes.

END OF SECTION

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Hanger, supports, and anchors.

B. Shop Drawings:

1. Shop Drawings: 1/4" = 1' foot scale. Show fabrication and installation details for metal ducts.
2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
3. Factory- and shop-fabricated ducts and fittings.
4. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
5. Elevation of top of ducts.
6. Dimensions of main duct runs from building grid lines.
7. Fittings.
8. Reinforcement and spacing.
9. Seam and joint construction.
10. Penetrations through fire-rated and other partitions.
11. Equipment installation based on equipment being used on Project.
12. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
13. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing not listed below.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to 1/4" = 1' scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetration of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.

b. Air outlets and inlets.

c. Speakers.

d. Sprinklers.

e. Access panels.

f. Perimeter moldings.

g. Mill work.

B. Welding certificates.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct Reinforcement Tables," for static-pressure class listed in this specification, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Shall be Type L-1, Pittsburgh seam and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct/Longitudinal Seams," for applicable sealing requirements, materials involved, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Unless specified below select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.

b. McGill AirFlow LLC.

c. SEMCO Incorporated.

d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.

b. Johns Manville.

c. Knauf Insulation.

d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

4. Solvent or Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Adhesive 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."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.

   b. Intervals of lined duct preceding unlined duct.

   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Base: Synthetic rubber resin.

3. Solvent: Toluene and heptane.

4. Solids Content: Minimum 60 percent.

5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant 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."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with the fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults, electrical equipment rooms and enclosures, and elevator equipment rooms.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.07 FIELD QUALITY CONTROL

A. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

3.08 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.09 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.010 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Variable-Volume Air-Handling Units:

a. Pressure Class: Positive 1-inch wg.

b. Minimum SMACNA Seal Class: A.

C. Return Ducts:

1. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 1-inch wg.

b. Minimum SMACNA Seal Class: A.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1/2-inch wg.

b. Minimum SMACNA Seal Class: C.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 1/2-inch wg.

b. Minimum SMACNA Seal Class: B.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type , 1-1/2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 3 with minimum 1.5 radius-to-diameter ratio.

b. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

b. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Conical spin in or 45-degree lead in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity all: 45-degree lateral.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Flange connectors.
4. Turning vanes.
5. Remote damper operators.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
   a. Special fittings.
   b. Manual volume damper installations.
   c. Control-damper installations.
   d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
   e. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. McGill AirFlow LLC.

b. Nailor Industries Inc.

c. Pottorff.

d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.

4. Frames:

a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.

b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

a. Molded synthetic.

b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.04 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

2.06 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Aluminum.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Steel.

2.07 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff.
7. Ventfabrics, Inc.
8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   d. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.

2.08 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.09 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

2.010 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Section 230553 "Identification for HVAC Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

M. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

N. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.
2. Ceiling-mounted ventilators.

1.03 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

C. Motors shall comply with Department of Energy standard 10 CFR Part 431.

D. Delegated Design: Design roof top fan supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

E. Wind-Restraint Performance:

1. Basic Wind Speed: 90 mph.
2. Building Classification Category: Refer to structural drawings.
3. Minimum 10 lb/sq. ft multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.04 ACTION SUBMITTALS

A. Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents. Deviation from Contract Documents must be approved by engineer prior to submittal.

B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

6. Roof curbs.

7. Fan speed controllers.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.

2. Wind Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

E. Units shall fit into the space available with adequate clearances meeting manufacturer's requirements for service and as determined by the Engineer. Submitted units, which do not meet these criteria, shall be rejected. The Contractor shall not assume that all of the manufacturers listed as acceptable manufacturers will provide a unit that will fit in the space allocated for the unit(s). If any system modifications are required to accommodate submitted equipment the contractor shall be responsible for all material, labor, and engineering cost.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

1.08 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

1.09 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.01 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Broan-NuTone LLC.
2. Broan-NuTone LLC; NuTone Inc.
3. Carnes Company.
4. Greenheck Fan Corporation.
5. Loren Cook Company.
6. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Isolation: Rubber-in-shear vibration isolators.

3. Manufacturer's standard roof jack or wall cap, and transition fittings.

G. Capacities and Characteristics:

1. Refer to schedule on drawings.

2.02 IN-LINE EXHAUST FANS

A. In-line Exhaust Fans shall be direct drive, forward curved, centrifugal blower type. Fan wheel and scroll shall be constructed of galvanized steel. Fan wheel shall be dynamically balanced. The fan housing shall be constructed of galvanized steel and acoustically lined for quiet operation. Fan housing shall be provided with mounting lugs for suspension above a ceiling. Provide fan with an integral aluminum gravity back-draft damper. The motor shall be permanently lubricated with built-in thermal overload protection. Provide a safety disconnect switch mounted to the exterior of the fan enclosure. Fans shall be AMCA rated.

2.03 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.04 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use manufacturers support kit.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 230553 "Identification for HVAC Equipment."

3.02 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233715
FIXED LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

1.03 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
2. Manufacturer's product data including performance data.
3. Preparation instructions and recommendations.
4. Storage and handling requirements and recommendations.
5. Installation methods.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.
3. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

1.05 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Qualification Data: For manufacturer and Installer.

C. Product Test Reports: For each type of louver, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranties: For manufacturer's warranties.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 WARRANTY

A. Manufacturer shall provide standard limited warranty for louver systems for a period of 20 years from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

B. Warranty shall include guarantees against, peeling, blistering, cracking, chalking, fading, and erosion.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated in structural documents.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Airolite Company, LLC (The).
   b. Greenheck Fan Corporation.
   c. Pottorff.
   d. Ruskin Company.
2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.080 inch for frames.
4. Mullion Type: Coordinate with Architect and Structural.
5. Louver Performance Ratings: Refer to schedule on drawings
6. Finish: Kynar, coordinate color with Architect.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

A. General: Provide screen at all louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.

2.05 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.06 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.07 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

B. Related Sections:

1. Section 232300 "Refrigerant Piping" for refrigerant piping requirements for split system air conditioners.

1.03 ACTION SUBMITTALS

A. Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents. Deviation from Contract Documents must be approved by engineer prior to submittal.

B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1. Indoor unit.
2. Outdoor unit.
3. Thermostat.
4. Air filter.
5. Refrigeration components.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

D. Units shall fit into the space available with adequate clearances meeting manufacturer’s requirements for service and as determined by the Engineer. Submitted units, which do not meet these criteria, shall be rejected. The Contractor shall not assume that all of the manufacturers listed as acceptable manufacturers will provide a unit that will fit in the space allocated for the unit(s). If any system

modifications are required to accommodate submitted equipment the contractor shall be responsible for all material, labor, and engineering cost.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.

2. Fan Belts: One set(s) for each air-handling unit fan if utilized.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. Motors shall comply with Department of Energy standard 10 CFR Part 431.

1.08 COORDINATION

A. Coordinate size and clearances of mechanical rooms, access spaces, electrical, and natural gas services with actual equipment provided.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fails in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.

b. For Parts: One year(s) from date of Substantial Completion.

c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AAON, Inc.
2. Carrier Corporation.
3. McQuay International.
4. Trane; American Standard Companies, Inc.
5. Johnson Controls Inc.

2.02 INDOOR UNITS

A. Evaporator-Fan Unit:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
4. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Condensate Drain Pans: Formed plastic or galvanized sheet metal drain pan coated with asphaltic waterproofing compound.

B. Fan: Centrifugal, forward curved, double-width wheel, factory balanced, resilient mounted, direct or belt drive.

1. Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

C. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2. Pleated 1" throwaway, minimum 90 percent arrestance, and MERV 13.

2.03 Smoke Detectors: (For units over 2000 cfm)

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. Detectors shall be four-wire type.

3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

6. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

a. Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Drawings or in "Remarks" column of a detector schedule.

b. Multiple levels of detection sensitivity for each sensor.

c. Sensitivity levels based on time of day.

B. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

a. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

b. Primary status.

c. Device type.

d. Present average value.

e. Present sensitivity selected.

f. Sensor range (normal, dirty, etc.).

2. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.

3. Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Drawings or in "Remarks" column of a detector schedule.

4. Each sensor shall have multiple levels of detection sensitivity.

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.04 OUTDOOR UNITS

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.

b. Refrigerant Charge: R-410A.

c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.

5. Motor: Permanently lubricated, with integral thermal-overload protection.

6. Low Ambient Kit: Permits operation down to 45 deg F.

7. Mounting Base: Concrete.

2.05 CONTROLS

A. Basic Unit Controls:

1. Control-voltage transformer.

2. Wall-mounted thermostat with the following features:

a. 7-day programmable scheduling.

b. Heat-cool-off switch.

c. Fan on-auto switch.

d. Fan-speed switch.

e. Automatic changeover.

f. Exposed set point.

g. Exposed indication.

h. Degree F indication.

i. Unoccupied-period-override push button.

2.06 ACCESSORIES

A. Automatic-reset timer to prevent rapid cycling of compressor.

B. Refrigerant Line: Refer to Section 232300 "Refrigerant Piping".

2.07 CAPACITIES AND CHARACTERISTICS

A. Refer to equipment schedules on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine factory-installed insulation before unit installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for electric, and refrigerant piping systems to verify actual locations of piping connections before equipment installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install units level and plumb.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

C. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

D. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

E. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.

F. Install and connect refrigerant tubing to allow access to unit.

3.03 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems.

C. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

E. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

F. Install electrical disconnects per code requirements insuring proper clearance and access.

G. Controls: Install thermostats at mounting height compliant with ADA guidelines.

H. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

I. Connect refrigerant tubing to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

1. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J.Comply with requirements in Section 232300 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Perform electrical test and visual and mechanical inspection.

3. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

4. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.

5. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

a. Inspect for physical damage to unit casings.

b. Verify that access doors move freely and are weathertight.

c. Clean units and inspect for construction debris.

d. Verify that all bolts and screws are tight.

e. Adjust vibration isolation and flexible connections.

f. Verify that controls are connected and operational

B. Adjust fan belts to proper alignment and tension.

C. Measure and record airflows.

D. Verify proper operation of capacity control device.

E. After startup and performance test, lubricate bearings and adjust belt tension.

3.06 DEMONSTRATION

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

END OF SECTION 238126

SECTION 26 0500
COMMON WORK RESULTS FOR ELECTICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Any changes or additional costs to other trades or to the project caused by a substitution, even if approved, shall be borne by the trade making the substitution.

B. Section Includes:
1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.02 SUBMITTALS

A. Any equipment or material submitted which is not in accordance with the specification requirements shall be specifically noted in the submittal letter of transmittal including all points of variance. Submitted items shall be functionally equal to the specified items. If the submittals do not include points of variance for substitutions, the Contractor remains responsible to execute his work in accordance with the contract documents even if submittals for substitutes are approved.

B. The Architect's approval of submittals indicates general compliance with the design concept, but shall not be considered as permitting any departure from the contract documents. Nor shall it relieve the Contractor's responsibility for any errors in the submittal, such as in details, dimensions, materials, etc.

C. If requested, the Contractor shall provide samples of materials or equipment he proposes to furnish. Such samples shall remain the property of the Contractor and will be returned before contract closeout.

D. Contractor shall submit dimensioned shop drawings of all electrical and telephone room layouts, and any other locations where electrical equipment is grouped. Shop drawings shall show relationship of electrical equipment with the building structure and equipment of other trades. Shop drawings shall also be provided for the following systems:
1. Telephone and data systems
2. Fire alarm system
3. Public address and sound systems
4. Lighting control systems

1.03 PRICING

A. The contractor shall prepare and present to architect, owner, or their representative pricing which shall include the list of equipment and labor in tabular form including; part numbers, item description, unit pricing, number of units, extended pricing and totals.
1.

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   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:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   4. Pressure Plates: Plastic or Carbon Steel. Include two for each sealing element.
   5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

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

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Building wires and cables rated 2000V and less.
2. Wires and cables for PV systems rated 2000V and less.
3. Connectors, splices, and terminations rated 2000V and less.

B. Related Requirements:

1. Sections 26 05 13 “Medium-Voltage-Cables” for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000V.
2. Section 26 0523 “Control-Voltage Electrical Power Cables” for control systems communications cables and Classes 1, 2, and 3 control cables.
3. Section 27 1500 “Communications Horizontal Cabling” for cabling used for voice and data circuits.

1.03 DEFINITIONS

A. VFC: Variable-Frequency Controller.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Qualifications Data: For Testing Agency

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.
1. Testing Agency’s Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in VFC circuits.

D. Conductors: Copper, complying with NEMA WC 70/ICEA S-95-658.
   1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW Type THW-2 Type THHN/THWN-2 Type XHHW-2 Type UF Type USE and Type SO.

E. Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI nonmetallic-sheathed cable, Type NM Type SE ONNECTORS AND SPLICES

F. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

   1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
   2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

   1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
   2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

E. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Types SER & USE cable are acceptable for dwelling unit Service Entrance Feeders where allowed by the NEC and IBC according to the construction type. Refer to architectural plans to determine construction type.

C. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

F. Type NMB cable is acceptable for dwelling units where allowed by the NEC and IBC according to the construction type. Refer to architectural plans to determine construction type.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points in accordance with Section 26 0533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.04 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 27 0528.29 "Hangers and Supports for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is **not** permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1 inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.05 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.06 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.07 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.08 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 "Penetration Firestopping."

3.09 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

   a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
   b. Test bolted connections for high resistance using one of the following:

      1) A low-resistance ohmmeter.
      2) Calibrated torque wrench.
      3) Thermographic survey.

   c. Inspect compression-applied connectors for correct cable match and indentation.
   d. Inspect for correct identification.
   e. Inspect cable jacket and condition.
   f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
   g. Continuity test on each conductor and cable.
   h. Uniform resistance of parallel conductors.

3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of product indicated.

B. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:

1. Test wells.
2. Rod electrodes.
3. Ring electrodes.
4. Grounding arrangements and connections for separately derived systems.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.03 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.

P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

Q. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

a. Material: Die-cast zinc alloy.
b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.05 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.06 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
1. Ground Ring: If lightning protection system is specified, install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
    a. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
    b. Bury ground ring not less than 24 inches from building's foundation.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 0543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than required by section 250 of the NEC.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

F. Grounding system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

   a. Hangers.
   b. Slotted support systems, hardware, and accessories.
   c. Clamps.
   d. Hangers.
   e. Sockets.
   f. Eye nuts.
   g. Fasteners.
   h. Anchors.
   i. Saddles.
   j. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittals: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Projectors.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

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

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Material: Plain steel.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
6. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 5000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 9123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 0533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.
8. Floorboxes

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Rigid HDPE: Comply with UL 651A.

F. Continuous HDPE: Comply with UL 651B.

G. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

H. RTRC: Comply with UL 1684A and NEMA TC 14.

I. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

J. Fittings for LFNC: Comply with UL 514B.

K. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70. Provide NEMA 3R for exterior locations.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.05 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

D. Verify color of surface raceways with architect unless color is specifically noted on drawings.

E. Where power receptacles and data/communications devices are located side by side, the surface raceway shall be Wiremold dual compartment V2400D Base and Blank Cover or approved equal.

F. Conduit shall not be used for surface raceways except in unfinished spaces, unless specifically noted otherwise on plans.

2.06 FLOORBOXES

A. Boxes in slab on-grade concrete floors:
1. Floor boxes shall be multiservice steel boxes designed for use in concrete floor slabs.
2. (FP) Floor Plug floor box for Power and Communications: Provide Wiremold RFB4E six-compartment multi-service recessed floor box including appropriate plates for four voice/data jacks and two duplex NEMA 5-20 receptacles. Route a minimum of one ¾" conduit for power and two 1-1/4" conduits for data to each floorbox unless noted otherwise.
3. (AV) Power, Data and Audio/Visual Floorbox: Provide Wiremold RFB6 Series equivalent floorbox Route a minimum of one ¾" conduit for power and three 1-1/4" conduits to each AV floorbox for communications cabling.
4. (FF) Furniture Feed Floorbox: Provide Wiremold floorbox with separate conduits for power and data. Conduit shall be a minimum of ¾" for power and two 1-1/4" for communications routed to accessible area. Conductors for modular furniture will be provided by others, and terminated in floor box by electrical contractor. Provide Furniture Feed Cover Assembly.

B. All floorboxes shall include all internal barriers, covers, device plates and other components necessary for a complete installation.

2.07 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:
1. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R as appropriate for the application with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:
1. NEMA 250, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.08 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.09 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.01 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC,.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

C. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

D. Minimum Raceway Size: 3/4-inch trade size.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

G. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

H. Surface raceway shall only be used on existing walls where construction type prohibits installation of EMT or MC cable inside wall (concrete or brick walls, for example).

I. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

a. Type 3R unless otherwise indicated.
b. Locations Exposed to Hosedown: Type 6
c. Locations Subject to Potential Flooding: Type 6P.
d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
e. Locations in-Ground or Exposed to Corrosive Agents: Type 6P.
f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: **Type 2**
c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
f. Locations Exposed to Hosedown: Type 6.
g. Locations Exposed to Brief Submersion: Type 6.
h. Locations Exposed to Prolonged Submersion: Type 6P.
i. Locations Exposed to Corrosive Agents: Type 6P.
j. Locations Exposed to Spraying Oil or Coolants: Type 13.

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:

1. Provide cast-metal boxes.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.03 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.
6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
9. Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG. Install insulated throat metal grounding bushings on service conduits.

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.

2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
    d. Conduit extending into pressurized duct and equipment.
    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    f. Where otherwise required by NFPA 70.

9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
10. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
11. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
12. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:

1. Types EMT-A, ERMC-A, and FMC-A:

    a. Do not install aluminum raceways or fittings in contact with concrete or earth.

2. Types ERMC and IMC:

    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

3. Type ERMC-S-PVC:

    a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
    b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing

locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC raceway.

c. Coat field-cut threads on PVC-coated raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

4. Types FMC, LFMC, and LFNC:

a. Comply with NEMA RV 3. Provide a maximum of 72 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

5. Types PVC and EPEC:

a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.

b. Comply with manufacturer's written instructions for solvent welding and fittings.

6. Type RTRC:

a. Do not install Type RTRC conduit where ambient temperature exceeds 230 deg F.

D. Raceways Embedded in Slabs:

1. Run raceways larger than metric designator 27 (trade size 1) below concrete slab.
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 2 inch of concrete without voids.
4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
5. Change from ENT to ERMC before rising above floor.

E. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERMC for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
2. EMT: Provide compression fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

G. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground RMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.04 INSTALLATION OF SURFACE RACEWAYS

A. Install surface raceways only where indicated on Drawings or on existing walls where construction type prohibits installation of EMT or MC cable inside wall (concrete or brick walls, for example).

B. Install surface raceway with a minimum 2 inch radius control at bend points.

C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.05 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
2. Provide gaskets for wallplates and covers.

3.06 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.07 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.08 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 26 0544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
    1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
    2. Pressure Plates: Carbon steel.
    3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

    1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:

1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.

C. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.
2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.
4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

D. Comply with NFPA 70E requirements for arc-flash warning labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.02 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 1000 V or Less:

1. Black letters on orange field
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color must be factory applied or field applied for sizes larger than 8 AWG if authorities having jurisdiction permit.
2. Colors for 208Y/120 V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 240 V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.

4. Colors for 480Y/277 V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

5. Color for Neutral: White
6. Color for Equipment Grounds: Green.
7. Colors for Isolated Grounds: Green with two or more yellow stripes.

C. Raceways and Cables Carrying Circuits at More Than 1000 V:

1. Black letters on orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on orange background.

E. Warning labels and signs must include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

F. Equipment Identification Labels:

1. Black letters on white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, polyester flexible label with acrylic pressure-sensitive adhesive.
1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend.
2. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:

a. 1-1/2 by 6 inch for raceway and conductors.
b. 3-1/2 by 5 inch for equipment.
c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F. Comply with UL 224.

2.05 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.

C. Tape and Stencil: 4 inch wide black stripes on 10 inch centers placed diagonally over orange background and are 12 inch wide. Stop stripes at legends.

D. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

E. Underground-Line Warning Tape:
1. Tape:

a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical [**and communications**]utility lines.
b. Printing on tape must be permanent and may not be damaged by burial operations.
c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW"

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 1 inch.

2.06 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

C. Write-on Tags:
1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.07 SIGNS

A. Baked-Enamel Signs:
1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4 inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inch.

B. Metal-Backed Butyrate Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4 inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inch.

C. Laminated Acrylic or Melamine Plastic Signs:
1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inch, minimum 1/16 inch thick.
b. For signs larger than 20 sq. inch, 1/8 inch thick.
c. Engraved legend with black letters on white face.
d. Self-adhesive.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.08 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 1000 V: Identification must completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

L. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

M. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

N. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

P. Self-Adhesive Labels:

1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high label; where two lines of text are required, use labels 2 inch high.

Q. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

W. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inch below finished grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

X. Metal Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

Y. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

Z. Write-on Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

AA. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inch high.

BB. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.

CC. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 1000 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3 inch high, black letters on 20 inch centers.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft maximum intervals.

D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 1000 V: Vinyl wraparound labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.

E. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.

F. Accessible Fittings for Raceways and Cables within Buildings: Identify cover of junction and pull box of the following systems with self-adhesive labels containing wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

G. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.

H. Power-Circuit Conductor Identification, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.

J. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with conductor designation.

K. Conductors to Be Extended in Future: Attach marker tape to conductors and list source.

L. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

M. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

N. Concealed Raceways and Duct Banks, More Than 1000 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inch of floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in building, or concealed above suspended ceilings.

O. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

P. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.

Q. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

R. Arc Flash Warning Labeling: Self-adhesive labels.

S. Operating Instruction Signs: Baked-enamel warning signs.

T. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

U. Equipment Identification Labels:

1. Indoor Equipment: Baked-enamel signs.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
    g. Substations.
    h. Emergency system boxes and enclosures.
    i. Motor-control centers.
    j. Enclosed switches.
    k. Enclosed circuit breakers.

l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power-transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION

SECTION 26 0573
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Software Developer

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.07 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Comply with IEEE 242 and IEEE 399.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.02 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 0572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
1. Switchgear.
2. Low-voltage switchgear.
3. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

3.03 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.04 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.05 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.

15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.06 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.07 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION

SECTION 26 0574
OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Software Developer.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
2. Operation and Maintenance Procedures: In addition to items specified in Section 01 7823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.07 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 0572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 26 0573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.03 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 0572 "Overcurrent Protective Device Short-Circuit Study."
2. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 26 0573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.04 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Control panel.

3.05 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.06 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electronic dial-time switches.
2. Electromechanical dial-time switches.
3. Outdoor photoelectric switches, solid state, flexible mounting.
4. Outdoor photoelectric switches, solid state, luminaire-mounted.
5. Outdoor photoelectric switches, low voltage.
6. Daylight-harvesting switching controls.
7. Daylight-harvesting dimming controls, analog.
8. Daylight-harvesting dimming controls, digital.
9. Indoor occupancy and vacancy sensors.
10. Switchbox-mounted occupancy sensors.
11. Digital timer light switch.
12. High-bay occupancy sensors.
13. Extreme-temperature occupancy sensors.
14. Outdoor motion sensors.
15. Lighting contactors.
16. Emergency shunt relay.
17. Conductors and cables.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 26 0011 "Facility Performance Requirements" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 26 2726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.02 ACTION SUBMITTALS

A. Product Data:

1. Electronic dial-time switches.
2. Electromechanical dial-time switches.
3. Outdoor photoelectric switches, solid state, flexible mounting.
4. Outdoor photoelectric switches, solid state, luminaire-mounted.
5. Outdoor photoelectric switches, low voltage.
6. Daylight-harvesting switching controls.
7. Daylight-harvesting dimming controls, analog.
8. Daylight-harvesting dimming controls, digital.
9. Indoor occupancy and vacancy sensors.
10. Switchbox-mounted occupancy sensors.
11. Digital timer light switch.
12. High-bay occupancy sensors.
13. Extreme-temperature occupancy sensors.
14. Outdoor motion sensors.
15. Lighting contactors.
16. Emergency shunt relay.

17. Conductors and cables.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

C. Field quality-control reports.

1.03 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranties.

1.04 WARRANTY

A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Extended Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER'S

A. If they comply with these specifications, products from the following, and only the following, manufacturers will be acceptable

1. ~~Reliable Lighting Controls (Blue Ridge) - Mike Ceritelli 214-435-9275~~

Siemens Lighting Controls

2.02 MANUFACTURED UNITS

A. All parts of the lighting control system shall be manufactured by the same company and shall be aesthetically compatible. i.e., from the same product line or family of products.

B. All sensors shall be from the latest release generation. Do not mix product of different releases or generations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. If the work is to be performed in an existing facility, visit the site of the proposed work and observe its conditions so that you may be fully informed as to the materials, labor, workmanship and conditions under which the work is to be done. If an existing lighting controls system exists, then the new system shall work with the existing system.

E. No allowances shall be made on account of any errors, negligence or failure to be aware of the condition of the existing site.

3.02 INSTALLATION

A. General
1. Provide all lighting controls as required and where indicated, in accordance with manufacturer's written instructions and project shop drawings, applicable requirements of the NEC, and recognized industry practices to ensure that products serve the intended function.
2. Provide the room controller as required located above the ceiling above the switches near the exit door. Provide a permanent label on the ceiling t-grid to identify its location. The label material shall be as described in section 26 0553. The label shall say "Lighting Controller". It is acceptable for a room controller to serve more than one space.
3. Provide conduit and wiring in accordance with specification sections 260519.

B. Shop Drawing Preparation: At least five working days prior to bid time, provide a set of floor plan drawings and a copy of these specifications to the manufacturer for the purpose of system layout with quantities and creating shop drawings for the owner. Coordinate with the manufacturer to determine the required medium (hard copy or electronic) and the format required by the manufacturer.

C. Sensor design and layout by Manufacturer:
1. Refer to Design Requirements article regarding sensor design and layout.
2. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.
3. Select the appropriate type of sensor for complete coverage of each space.

3.03 SEQUENCE OF OPERATION

A. Lighting Controls
1. The smart switch shall be required to be pressed to turn the lights on in all spaces where a vacancy sensor is required. Otherwise, an occupancy sensor may automatically turn the luminaires on. Two minutes prior to turning the lights off, the lighting controls shall dim the luminaires in the space to 50% of their previous output as a notification to the occupants that the controls will soon turn the lighting off. A momentary "blink" is allowed if luminaires are not dimmable. If the motion sensor is not triggered in two minutes, the lighting in the space is to turn off. If the motion sensor is triggered, the lighting controls shall dim the lighting back up to the previous lighting level and timeout is restarted. In spaces with timer switches, the system shall accept an override signal at any time either before or after the lighting is turned off. The occupant shall not be required to wait for the lights to go out before issuing the override.

2. Where shown on the plans, a photocell is to be used to measure the light level and signal to the room controller to dim the luminaires continuously (from 100% to 15% or lower, including off) in the daylight zone to maintain a consistent (within +10% and -0%) lighting level in the space.

3.04 MANUFACTURER'S FIELD SERVICES

A. Coordinate with the sales representative to coordinate the below requirements with the manufacturer.
   1. The manufacturer shall provide instruction at the start of the job to Contractor regarding the proper installation of the system.
   2. As part of the system startup process, the manufacturer shall provide all initial field programming of the system.
   3. Using certified factory representatives, the manufacturer shall inspect the finished installation against the shop drawings and installation instructions.
   4. Using certified factory representatives, the manufacturer shall do functional testing of the finished installation. Submit documentation of the functional testing in accordance with Part 1 of this specification.

3.05 ADJUSTING

A. Motion sensors may be affected by various conditions in the room. It may be necessary for Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. Contractor is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.

B. Work with the manufacturer to correct all findings from manufacturer functional testing.

C. Work with the manufacturer to correct all findings made by the third party commissioning agent or registered design professional, whichever entity performs the commissioning service. This contractor is responsible for the entire lighting control system and luminaires to pass the commissioning inspection and reporting.

3.06 OWNER'S TRAINING AND DEMOSTRATION

A. Upon completion of testing and adjustment, demonstrate operation of the system to representatives of Owner.

B. Instruct Owner's personnel in proper maintenance, adjustment, and operation of the motion sensor lighting controls.

C. Discuss with Owner the time clock feature programming requirements (on/off times and school schedule) and teach them to program the clock feature to match the required schedule.

D. Upon completion of testing and adjustment (commissioning), Contractor and a direct employee of the equipment manufacturer (who is already familiar with the details of the project) shall demonstrate operation, proper maintenance, troubleshooting and adjustment of the lighting control system and all sensors throughout the building. Owner shall receive a minimum of 4 hours and a maximum of 8 hours in an on-site training session. The length of the training session shall be at the discretion of Owner. The training shall cover the following areas in detail:
   1. Scope of system: Review the as-built documentation with Owner to detail extent of system. Identify locations of all wall stations, wiring, and panels that fall within the scope of the lighting control system. Define clear lines of scope between lighting control system and EMS functions if applicable.
   2. Operation of system: Cover normal operation of switches, push-buttons, LCD interfaces and software (if provided). Provide documentation to Owner showing the operational zoning of

controlled circuits and all time-clock events programmed into the Lighting Control System. Show Owner how to change and add/delete events.

3. Maintenance and Troubleshooting of system: Detail any required or optional preventive maintenance actions required of Owner. Go over step-by-step procedures to troubleshoot all possible failure modes of each component type of the lighting control system. Cover procedure to get lights turned on in any space containing a lighting control system in the event the control system fails. Identify any specialized equipment necessary to support all the above actions.
4. Service and Support of system: Identify nearest direct support contact for the manufacturer and provide both telephone and email contact details.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.
5. Disconnecting and overcurrent protective devices.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 26 0011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.02 DEFINITIONS

A. GFEP: Ground-fault equipment protection.

B. MCCB: Molded-case circuit breaker.

C. VPR: Voltage protection rating.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.
5. Disconnecting and overcurrent protective devices.
6. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
7. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.
7. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

B. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Recommended procedures for installing panelboards.
2. Recommended torque settings for bolted connections on panelboards.
3. Recommended temperature range for energizing panelboards.

C. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
2. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation in accordance with NECA 407

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Provide equipment from one of the following manufacturers:
1. Square D
2. Eaton
3. General Electric

B. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces defined in Section 26 0548.16 "Seismic Controls for Electrical Systems."

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

G. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: UL 50E, Type 1.
b. Outdoor Locations: UL 50E, Type 3R
c. Kitchen and Wash-Down Areas: UL 50E, Type 4X
d. Other Wet or Damp Indoor Locations: UL 50E, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, Type 5.

2. Height: 7 ft maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

H. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.

I. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

    a. Bus must be fully rated for entire length.

2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors must be sized for double-sized or parallel conductors as indicated on Drawings.
7. Do not mount neutral bus in gutter.
8. Split Bus: Vertical buses divided into individual vertical sections.

J. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations must allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with lug on neutral bar for each pole in panelboard.
5. Ground Lugs and Bus-Configured Terminators: Compression type, with lug on bar for each pole in panelboard.
6. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Compression type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

K. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

L. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 10 percent.

M. Panelboard Short-Circuit Current Rating:

1. Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction. Include label or manual with size and type of allowable upstream and branch devices listed and labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series-connected short-circuit rating.

a. Panelboards rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

2. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.

a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

N. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.02 POWER PANELBOARDS

A. Listing Criteria: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inch, provide two latches, keyed alike.

C. Mains: Circuit breaker or lugs only as indicated on schedule.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers or plug-in types with a positive locking feature.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers or plug-in types with a positive locking feature.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or lugs only as indicated on schedule.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

    a. Inverse time-current element for low-level overloads.
    b. Instantaneous magnetic trip element for short circuits.
    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event must be recorded with type, phase, and magnitude of fault that caused trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30 mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240 V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards in accordance with NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NECA 407.
2. Consult Architect for resolution of conflicting requirements.

C. Equipment Mounting:

1. Floor-mounted panelboards shall be installed on cast-in-place concrete equipment base(s).
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

D. Interfaces with Other Work:

1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems."

B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.

F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.

G. Circuit Directory:

1. Provide directory card inside panelboard door, mounted in transparent card holder.

    a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

    a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3. Create directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Field tests and inspections must be witnessed **by** authorities having jurisdiction.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Nonconforming Work:

1. Panelboards will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

E. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Manufacturer Services:

1. Engage factory-authorized service representative to supervise field tests and inspections.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within panelboard, may not exceed 20 percent.

3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION

SECTION 26 2726
WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade single straight-blade receptacles.
3. General-grade duplex straight-blade receptacles.
4. Hospital-grade straight-blade receptacles.
5. Receptacles with arc-fault and ground-fault protective devices.
6. Locking receptacles.
7. Pin-and-sleeve receptacles.
8. Special-purpose power outlet assemblies.
9. Connectors, cords, and plugs.
10. Wall switch sensor light switches with dual technology sensors.
11. Wall switch sensor light switches with passive infrared sensors.
12. Wall switch sensor light switches with ultrasonic sensors.
13. Digital timer light switches.
14. Wall-box dimmers.
15. Wall plates.
16. Floor service outlets.
17. Poke-through assemblies.
18. Prefabricated multioutlet assemblies.

1.03 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect**,** Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.06 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Sustainable Design Closeout Documentation:

B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Extra Keys for Key Lock Switches: One of each kind.
2. SPD Receptacles: Equal to 10 percent of quantity installed for each kind specified, but no fewer than one units.
3. Controlled Receptacles: Equal to 10 percent of quantity installed for each kind specified, but no fewer than one units.
4. Cord Connectors: One of each kind.

B. Special Tools:

1. Proprietary equipment and software required to maintain, repair, adjust, or implement future changes to controlled receptacles.
2. Proprietary equipment required to maintain, repair, adjust, or implement future changes to cord connectors.

1.09 WARRANTY FOR DEVICES

A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: Three years from date of Substantial Completion; prorated coverage for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: Eight years from date of Substantial Completion; prorated coverage for materials that failed because of transient voltage surges only, free on board destination, freight prepaid.

PART 2 - PRODUCTS

2.01 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. Switches, 120/277 V, 20 A:
1) Description: Single pole or double pole and three-way or four way switches as indicated on plans.
c. Key-Operated Switches: 120/277 V, 20 A.
1) Description: Single pole, with factory-supplied key in lieu of switch handle.
d. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

2.02 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:
a. Configuration:

1) General-duty, NEMA 5-20R.
2) General-duty, smooth face, NEMA 5-20R.
3) General-duty, NEMA 6-20R.
4) General-duty, smooth face, NEMA 6-20R.
5) Extra-heavy-duty, NEMA 5-20R.
6) Extra-heavy-duty, NEMA 6-20R.

4. Accessories:

    a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.03 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:
1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

    a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:
    a. Configuration:

        1) General-duty, NEMA 5-20R.
        2) General-duty, smooth face, NEMA 5-20R.
        3) General-duty, NEMA 6-20R.
        4) General-duty, smooth face, NEMA 6-20R.
        5) Heavy-duty, NEMA 5-20R.
        6) Heavy-duty, smooth face, NEMA 5-20R.
        7) Heavy-duty, NEMA 6-20R.
        8) Heavy-duty, smooth face, NEMA 6-15R.
        9) Heavy-duty, NEMA 7-15R.
        10) Extra-heavy-duty, NEMA 5-20R.
        11) Extra-heavy-duty, smooth face, NEMA 5-20R.
        12) Extra-heavy-duty, NEMA 6-20R.
        13) Extra-heavy-duty, smooth face, NEMA 6-20R.

4. Accessories:

    a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Tamper-Resistant Duplex Straight-Blade Receptacle:
1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

    a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:

        1) General-duty, NEMA 5-20R.
        2) General-duty, smooth face, NEMA 5-20R.
        3) Heavy-duty, NEMA 5-20R.

4) Heavy-duty, smooth face, NEMA 5-20R.
5) Extra-heavy-duty, NEMA 5-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

C. Isolated Ground Duplex Straight-Blade Receptacle:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:
a. Configuration:

1) General-duty, NEMA 5-20R.
2) General-duty, smooth face, NEMA 5-20R.
3) Heavy-duty, NEMA 5-20R.
4) Heavy-duty, smooth face, NEMA 5-20R.
5) Extra-heavy-duty, NEMA 5-20R.
6) Extra heavy-duty, NEMA 6-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

D. Isolated Ground Duplex Straight-Blade Receptacle with Type 3 Surge Protective Device:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards:

1) UL CCN RTRT and UL 498.
2) Surge Protective Devices: UL 1449, Type 3.

3. Options:
a. Configuration: Heavy-duty, smooth face, NEMA 5-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

E. Tamper-Resistant Duplex Straight-Blade Receptacle with USB Outlet to Power Class 2 Equipment:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:
a. Configuration:

1) General-duty, NEMA 5-20R; two USB-A ports.
2) General-duty, NEMA 5-20R; two USB-C ports.
3) General-duty, NEMA 5-20R; one USB-A port; one USB-C port.
4) General-duty, smooth face, two USB-A ports.
5) General-duty, smooth face, four USB-A ports.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

F. Wired Half-Controlled Duplex Straight-Blade Receptacle:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN RTXI and UL Subject 498B.

3. Options:
a. Configuration: NEMA 5-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.04 RECEPTACLES WITH ARC-FAULT AND GROUND-FAULT PROTECTIVE DEVICES

A. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI Device:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN AWBZ, UL 498, UL 1699, and UL Subject 1699A.
b. Configuration: Heavy-duty, NEMA 5-20R.

3. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI and GFCI Device:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN KCXX, UL 498, UL 943, UL 1699, and UL Subject 1699A.

3. Options:
a. Configuration: Heavy-duty, NEMA 5-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

C. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.

3. Options:
a. Configuration: Heavy-duty, NEMA 5-20R.

4. Accessories:

a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

D. General-Grade, Weather-Resistant, Tamper-Resistant, Nightlight-Type, Lighted Duplex Straight-Blade Receptacle with GFCI Device :
1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.

3. Options:
   a. Configuration: Heavy-duty, NEMA 5-20R.

4. Accessories:

   a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
   b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

E. NEMA, 125 V, Locking Receptacle.
1. Regulatory Requirements:

   a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

   a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:

   a. Device Color: Black with yellow voltage indication on face.

F. NEMA, 125 V, Isolated Ground Locking Receptacle:

1. Regulatory Requirements:

   a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

   a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:

   a. Device Color: Black with yellow voltage indication on face.

G. NEMA, 250 V, Locking Receptacle:

1. Regulatory Requirements:

   a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

   a. Reference Standards: UL CCN RTRT and UL 498.

3. Options:

   a. Device Color: Black with blue voltage indication on face.

H. NEMA, 250 V, Isolated Ground Locking Receptacle:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

2.05 PIN-AND-SLEEVE RECEPTACLES

A. C2 Series, 125/250 V, Pin-and-Sleeve Receptacles:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN QLIW, UL 1682, and UL 1686.
b. Series: UL 1686 C2 and IEC 60309-2 Series II.
c. Voltage Rating: 125/250 V.

2.06 SPECIAL-PURPOSE POWER OUTLET ASSEMBLIES

A. Power Outlet Cord Management Assembly:

1. Source Limitations: Obtain all components for each power outlet cord management assembly from single manufacturer.
2. Regulatory Requirements: Components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
3. General Characteristics: Provide the following specified products with fabricated power outlet cord management assembly:

2.07 CONNECTORS, CORDS, AND PLUGS

A. Outdoor-Use, Watertight, Sealed Cord Connector:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN AXUT and UL 498.

3. Options:

a. Configuration:

1) NEMA 5-15
2) NEMA 5-20
3) NEMA 6-15.
4) NEMA 6-20.
5) NEMA L5-15.
6) NEMA L5-20
7) NEMA L5-30.
8) NEMA L6-15.
9) NEMA L6-20.
10) NEMA L6-30.
11) NEMA L7-15.
12) NEMA L7-20.
13) NEMA L7-30.
14) NEMA L14-20.
15) NEMA L14-30.
16) NEMA L15-20.
17) NEMA L15-30.
18) NEMA L16-20.
19) NEMA L16-30.
20) NEMA L17-30.
21) NEMA L18-30.

2.08 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

A. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
2. Integral relay for connection to BAS.
3. Adjustable time delay up to 30 minutes.
4. Able to be locked to either Automatic-On or Manual-On mode.
5. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
6. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.09 WALL SWITCH SENSOR LIGHT SWITCH, PASSIVE INFRARED

A. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
2. Integral relay for connection to BAS.
3. Adjustable time delay of 30 minutes.
1. Able to be locked to either Automatic-On or Manual-On mode.
2. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
3. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.10 WALL SWITCH SENSOR LIGHT SWITCH, ULTRASONIC

A. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.

2. Integral relay for connection to BAS.
3. Adjustable time delay up to 30 minutes.
1. Able to be locked to either Automatic-On or Manual-On mode.
2. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
3. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.11 WALL-BOX DIMMERS

A. In all locations, contractor or lighting supplier shall verify compatibility of dimmer control with fixtures to be supplied.

B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

C. Control: Continuously adjustable with single-pole or three-way switching. Comply with UL 1472.

D. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices.

E. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Coordinate with architect for color and material. Where plastic is required, plates shall be unbreakable nylon.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.13 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Round, with satin finish, verify color with architect.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.14 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

3. Standby Power System Receptacles: Orange.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receptacles:

1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.02 INSTALLATION OF SWITCHES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 0553 "Identification for Electrical Systems."

a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
b. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

3.03 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.

a. Hospital-Grade Receptacle Orientation: Orient receptacle with ground pin or neutral pin at top.

4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 0553 "Identification for Electrical Systems."

   a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
   b. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

D. Interfaces with Other Work:

1. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.

3.04 INSTALLATION OF LOCKING RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 0553 "Identification for Electrical Systems."

   a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.05 INSTALLATION OF PIN-AND-SLEEVE RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in UL 1686.
4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 0553 "Identification for Electrical Systems."

a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box. t

2. inspections.

3.06 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Test straight-blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz..

F. Wiring device will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.07 SYSTEM STARTUP FOR SWITCHES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks for momentary switches, dimmer switches, and fan-speed controller switches in accordance with manufacturer's instructions.

3.08 ADJUSTING

A. Occupancy Adjustments for Controlled Receptacles: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.09 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

B. Connectors, Cords, and Plugs:

1. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 2813
FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

    a. Control circuits.
    b. Motor-control centers.
    c. Panelboards.
    d. Switchboards.
    e. Enclosed controllers.
    f. Enclosed switches.

2. Spare-fuse cabinets.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Coordination charts and tables and related data.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project.
4. Coordination charts and tables and related data.

1.05 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class T, fast acting.

3.03 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.04 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 2816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nonfusible switches.
2. Shunt trip switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 26 0011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.02 DEFINITIONS

A. GFEP: Ground-fault circuit-interrupter for equipment protection.

B. GFLS: Ground-fault circuit-interrupter for life safety.

C. SPDT: Single pole, double throw.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).
5. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in **PDF** electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing enclosed switches and circuit breakers, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.07 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: Three years from date of Substantial Completion; prorated coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations: Obtain products from single manufacturer.
1. Acceptable Manufacturer's:
   a. Square D
   b. Cutler Hammer
   c. Siemens
   d. General Electric

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.02 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Three Pole, Single Throw, 600 V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Service-Rated Switches: Labeled for use as service equipment.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6.

2.03 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers must be constructed using glass-reinforced insulating material. Current carrying components must be completely isolated from handle and accessory mounting area.

B. Circuit breakers must have toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. Circuit-breaker handle must be over center, be trip free, and reside in tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon must be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit-breaker tripping mechanism for maintenance and testing purposes.

C. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings must be clearly marked on face of circuit breaker. Circuit breakers must be 100 percent rated or series rated as indicated on Drawings. Circuit breaker/circuit breaker combinations for series connected interrupting ratings must be listed by UL as recognized component combinations. Series rated combination used must be marked on end-use equipment along with statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

D. MCCBs must be equipped with device for locking in isolated position.

E. Lugs must be suitable for 60 deg C rated wire on 125 A circuit breakers and below, 75 deg C rated wire otherwise.

F. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, RMS sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

K. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

L. GFLS Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6 mA trip).

M. GFEP Circuit Breakers: With Class B ground-fault protection (30 mA trip).

N. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
3. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

2.04 MOLDED-CASE SWITCHES

A. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

B. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

C. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs:

a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
b. Lugs must be suitable for 60 deg C rated wire on 125 A circuit breakers and below, 75 deg C rated wire otherwise.

2.05 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

C. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as UL 50E Type 4, 4X stainless steel, 12, or 12K must have dual cover interlock mechanism to prevent unintentional opening of enclosure cover when circuit breaker is ON and to prevent turning circuit breaker ON when enclosure cover is open.

F. UL 50E Type 7/9 enclosures must be furnished with breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.02 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than 14 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's and Owner’s written permission.
4. Comply with NFPA 70E.

3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.04 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

3. Comply with mounting and anchoring requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
4. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in fusible devices.

3.05 IDENTIFICATION

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

B. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.07 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.08 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.09 MAINTENANCE

A. Infrared Scanning of Enclosed Switches and Breakers: Two months after Substantial Completion, perform infrared scan of joints and connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.

1. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Follow-up Infrared Scanning: Perform two follow-up infrared scans of enclosed switches and breakers, one at four months and another at 11 months after Substantial Completion.
3. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
4. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION

SECTION 26 4313
SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type 1 surge protective devices (SPDs).
2. Type 2 surge protective devices (SPDs).
3. Type 3, Type 4, and Type 5 surge protective devices (SPDs).
4. Enclosures.
5. Conductors and cables.

B. Related Requirements:
1. Section 26 2413 "Switchboards" for integral SPDs installed by switchboard manufacturer.
2. Section 26 2416 "Panelboards" for integral SPDs installed by panelboard manufacturer.

1.02 DEFINITIONS

A. I_n: Nominal discharge current.

B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.

D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).

E. SCCR: Short-circuit current rating.

F. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

G. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

H. Type 3 SPDs: Point of utilization SPDs.

I. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.

J. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.

K. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.03 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include electrical characteristics, specialties, and accessories for SPDs.
b. Certification of compliance with UL 1449 by qualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:

1) Tested values for VPRs.
2) I_n ratings.
3) MCOV, type designations.
4) OCPD requirements.
5) Manufacturer's model number.
6) System voltage.
7) Modes of protection.

B. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.05 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that SPDs perform in accordance with specified requirements and agrees to provide repair or replacement of SPDs that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: Five year(s) from date of Substantial Completion, for labor, materials, and equipment.

PART 2 - PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.02 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 2.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2

1. SPDs with the following features and accessories:

    a. Integral disconnect switch.
    b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
    c. Indicator light display for protection status.
    d. Form-C contacts rated at 2 A and 24-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
    e. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Line to Line: 1000 V.

F. SCCR: Equal to or exceed that of the panelboard or switchboard connected to the SPD.

G. Nominal Rating: 20 kA.

2.03 PANEL SUPPRESSORS

A. SPDs: Comply with UL 1449, Type 1.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

C. Comply with UL 1283.

D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

A. SCCR: SCCR: Equal to or exceed that of the panelboard or switchboard connected to the SPD.

B. Nominal Rating: 20 kA.

2.04 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

2.05 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD. OCPD ratings including ampacity shall be in accordance with SPD manufacturer’s recommendations.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

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

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 5119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.

1. Include Samples of luminaires and accessories involving color and finish selection.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of luminaire.

E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: **Five** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

A. For all fixtures with screw-in sockets (incandescent sockets, etc.), contractor shall provide and install a compatible LED lamp. Manufacturer shall label fixture with a maximum wattage equal to that of the specified lamp unless noted otherwise

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

D. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. Recessed Fixtures: Comply with NEMA LE 4.

F. CRI of minimum 80.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output where dimming is shown on plans or in schedule. Contractor is responsible for providing compatible dimming control for all fixture types provided.

H. Internal driver.

2.02 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.

c. CCT and CRI for all luminaires.

2.03 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.04 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

   a. Two 5/32-inch diameter aircraft cable supports adjustable to 10 feet in length.
   b. Hook mount.

2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

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

C. Prepare test and inspection reports.

3.06 STARTUP SERVICE

A. Contractor shall test operation of all fixtures and controls. Contractor shall program and adjust all components to provide a fully functional system in accordance with owner’s requirements.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 5619
LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Luminaire-mounted photoelectric relays.
   2. Luminaire types.
   3. Materials.
   4. Finishes.
   5. Luminaire support components.

B. Related Requirements:
   1. Section 26 0923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.02 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
      b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   6. Wiring diagrams for power, control, and signal wiring.

7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

E. Delegated Design Submittals: For luminaire supports.
1. Include design calculations for luminaire supports.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of the following:
1. Luminaire.
2. Photoelectric relay.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.07 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

E. Mockups: For exterior luminaires, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.09 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures, including luminaire support components.
    b. Faulty operation of luminaires and accessories.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance:

1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
2. Luminaires and lamps shall be labeled vibration and shock resistant.

2.02 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Bulb shape complying with ANSI C79.1.

G. CRI of minimum 80. CCT of 3000 K.

H. L70 lamp life of 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: As indicated on drawings.

L. In-line Fusing: Separate in-line fuse for each luminaire.

M. Lamp Rating: Lamp marked for outdoor use.

N. Source Limitations:

1. Obtain luminaires from single source from a single manufacturer.
2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.03 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
    a. "USE ONLY" and include specific lamp type.
    b. Lamp diameter, shape, size, wattage and coating.
    c. CCT and CRI for all luminaires.

2.04 FINISHES

A. Verify finish color of all light fixtures with architect prior to purchasing.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
a. Color:
1) As selected from manufacturer's standard catalog of colors.
2) Match Architect's sample of manufacturer's standard color.
3) As selected by Architect from manufacturer's full range.

2.05 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533.13 "Conduits for Electrical Systems" for wiring connections and wiring methods.

3.04 INSTALLATION OF BOLLARD LUMINAIRES

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.05 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.06 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 0533.13 "Conduits for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.07 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Photoelectric Control Operation: Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
   a. IES LM-5.
   b. IES LM-50.
   c. IES LM-52.
   d. IES LM-64.
   e. IES LM-72.
2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.09 DEMONSTRATION

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

3.10 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of Architect.

END OF SECTION

SECTION 28 3111
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Air-sampling smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Device guards.
8. Firefighters' two-way telephone communication service.
9. Magnetic door holders.
10. Remote annunciator.
11. Graphic annunciator.
12. Addressable interface device.
13. Digital alarm communicator transmitter.
14. Radio alarm transmitter.
15. Network communications.
16. System printer.

B. Related Requirements:

1. Section 28 0513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.03 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    e. Locate detectors according to manufacturer's written recommendations.
    f. Show air-sampling detector pipe routing.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.

2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.06 Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72.

1.09 PROJECT CONDITIONS

A. Contractor shall provide a new fully functional fire alarm system for the facility.

B. Acceptable Manufacturer’s
1. Honeywell
2. Simplex Grinnell
3. Any other owner approved manufacturer

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Acceptable Manufacturer’s:

1. New products required for modification and extension of existing fire alarm system shall be by the same manufacturer of the existing system to maintain compatibility with portion of fire alarm system that is to remain.

C. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

D. Automatic sensitivity control of certain smoke detectors.

E. All components provided shall be listed for use with the selected system.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.
10. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Record events in the system memory.
10. Record events by the system printer.
11. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe.
3. Alert and Action signals of air-sampling detector system.
4. Independent fire-detection and -suppression systems.
5. User disabling of zones or individual devices.
6. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central-station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control command and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

    a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium**.**

N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type except where four wire type is needed for AHU shutdown or other similar functions.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.06 PROJECTED BEAM SMOKE DETECTORS

A. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.

B. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.

C. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present average value.
4. Present sensitivity selected.
5. Sensor range (normal, dirty, etc.).

2.07 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.08 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Continuous Linear Heat-Detector System:

1. Detector Cable: Rated detection temperature 155 deg F. Listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.
2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.09 AIR-SAMPLING SMOKE DETECTOR

A. General Description:

1. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
2. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
3. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.
4. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
5. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.
6. Pipe airflow balancing calculations shall be performed using approved calculation software.

B. Detector:

1. Detector, Filter, Aspirator, and Relays: Housed in a mounting box and arranged in such a way that air is drawn from the detection area and a sample passed through the dual-stage filter and detector by the aspirator.
2. Obscuration Sensitivity Range:
3. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and a programmable scan time delay. The threshold set points shall be programmable.

    a. The four alarm thresholds may be used as follows:

        1) Alarm Level 1 (Alert): Activate a visual and an audible supervisory alarm.
        2) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm.
        3) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
        4) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.

b. Final Detection System Settings: Approved by Architect and Owner.
c. Initial Detection Alarm Settings:

1) Alarm Level 1 (Alert): 0.08 percent obs/ft.
2) Alarm Level 2 (Action): 1.0 percent obs/ft.
3) Alarm Level 3 (Fire 1): 2.0 percent obs/ft.
4) Alarm Level 4 (Fire 2): 4.0 percent obs/ft.

4. Power Supply:

a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.
b. Battery backup shall provide 24 hours' standby, followed by 30 minutes at maximum connected load.

5. Detector shall also transmit the following faults:

a. Detector.
b. Airflow.
c. Filter.
d. System.
e. Zone.
f. Network.
g. Power.

6. Provide four in-line sample pipe inlets that shall contain a flow sensor for each pipe inlet. The detector shall be capable of identifying the pipe from which smoke was detected.
7. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 feet in total, (four pipe runs per detector) with a transport time of less than 120 seconds from the farthest sample port.
8. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.
9. Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
10. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) shall be capable of storing up to 18,000 events.
11. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms.

C. Displays:

1. Include display module within each detector.
2. Each display shall provide the following features at a minimum:

a. A bar-graph display.
b. Four independent, high-intensity alarm indicators (Alert, Action, Fire 1, and Fire 2), corresponding to the four alarm thresholds of the indicated sector.
c. Alarm threshold indicators for Alert, Action, and Fire 1.
d. LED indication that the first alarm sector is established.
e. Detector fault and airflow fault indicators.
f. LED indicators shall be provided for faults originating in the particular zone (Zone Fault), faults produced by the overall smoke-detection system, and faults resulting from network wiring errors (Network Fault).
g. Minor and urgent LED fault indicators.

D. Sampling Tubes:

1. Smooth bore with a nominal 1-inch OD and a 7/8-inch ID. Sampling pipe with between 5/8- and 1-inch ID can be used in specifically approved locations when recommended by manufacturer.
2. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."

3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

E. Sampling Holes:

1. Sampling holes of 5/64 inch, or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
3. Each sampling point shall be identified by an applied decal.

2.10 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

a. Candella level as required by the dimensions and conditions in each space, or 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

G. Voice/Tone Notification Appliances:

1. Comply with UL 1480.

2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

H. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.11 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described in Section 23 0993.11 "Sequence of Operations for HVAC DDC."
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.12 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.13 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.14 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture [**one**] [**two**] telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.15 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.16 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

C. Provide integration gateway compatible with building automation system.

2.17 SYSTEM PRINTER

A. Printer shall be listed and labeled as an integral part of fire-alarm system.

2.18 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.

2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Equipment Mounting: Install fire-alarm control unit on concrete base.

1. Install seismic bracing. Comply with requirements in Section 26 0548.16 "Seismic Controls for Electrical Systems."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Equipment Mounting: Install fire-alarm control unit on finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."

E. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."

F. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

G. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B]in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

H. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

J. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

K. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

L. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

M. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

N. Device Location-Indicating Lights: Locate in public space near the device they monitor.

O. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

3.03 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.04 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 7100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Electronically locked doors and access gates.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Data communication circuits for connection to building management system.
8. Data communication circuits for connection to mass notification system.
9. Supervisory connections at fire-extinguisher locations.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.06 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.07 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.08 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.09 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

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

END OF SECTION

SECTION 31 0000
EARTHWORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Excavating, filling, backfilling, grading, and compacting of earth at the site.
   2. Preparation of building pad to limits shown on plans.
   3. Provide and stockpile topsoil on site.
   4. Dewatering excavations.

B. Related Sections:
   1. Section 31 2300 – Excavation and Fill

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM D 698-78 Tests Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Hammer and 12-in. Drop.
   2. ANSI/ASTM D2922 - Density of Soil in Place by the Nuclear Methods.

1.04 SUBMITTALS

A. Submit all submittals to Architect & Engineer.

B. Test Reports:
   1. Submit copies of test reports to Architect & Engineer.
   2. Compaction Tests: Submit copies of compaction test reports.

1.05 QUALITY ASSURANCE

A. Laboratory Control: On site or Imported topsoil, if required, shall be inspected and tested by an independent testing laboratory.
   1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

1.06 PROJECT CONDITIONS

A. Temporary Sheeting: Shore and sheet excavations to protect utilities and to prevent cave-in. Maintain sheeting secure until permanent construction is in place. Remove sheeting as excavations are backfilled.

B. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.

C. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.

D. Protection:
   1. Property: Protect adjoining property, including improvements out-side the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.
   2. Protect benchmarks.
   3. Protect above and below grade utilities which are to remain.
   4. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Monitor shoring system and surrounding ground surface during construction to detect movement. If movement becomes significant, take contingency steps to brace excavation and adjacent utility lines.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil:
   1. Strip topsoil from limits of grading areas, clean of grass, roots, rocks and debris to a depth of between 4" to 6", and stockpile for placement on all landscape and “open space” areas. Contractor shall investigate the site to his satisfaction to determine if suitable material is available on site to meet the specification for topsoil.
   2. Unsuitable Materials: Topsoil or unclassified fill will be declared as "unsuitable" if any of the following conditions or matter and particles are present to a degree that is judged detrimental to the proposed use of the material:
      a. Moisture.
      b. Decayed or un-decayed vegetation.
      c. Hardpan clay, heavy clay, or clay balls.
      d. Rubbish.
      e. Construction rubble.
      f. Sand or gravel.
      g. Rocks, cobbles, or boulders.
      h. Cementitious matter.
      i. Foreign matter of any kind.
   3. Unsuitable materials shall be disposed of as "waste".
   4. Wet Material: If fill material is unsatisfactory for use as embankment solely because of high moisture content, the Architect may grant the Contractor permission to process the material to reduce the moisture content to a usable optimum condition.

B. Unselected Earth Fill: Clean, sandy soil, free of organic matter and refuse, roots, clay lumps and with no rocks larger than 4", with a liquid limit less than 60.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and grades using a licensed surveyor.

C. Maintain bench marks, monuments and other reference points.

3.02 PREPARATION

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.
B. Notify utility companies sufficiently in advance to remove and relocate lines which are in way of excavation.
C. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.
D. Protect and support utility services uncovered by excavation.
E. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.
F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.
G. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Architect.
H. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded. Fill stump holes and like small excavations with suitable material placed in lifts and thoroughly tamped.
I. Scarify the subgrade soil of pavement areas to a minimum depth of 6 inches, water and recompact. Soil moisture should be adjusted to +1 to +4 percentage points above their optimum moisture content and compacted to minimum of 95 percent of their maximum dry density per ASTM D698 (Standard Proctor).
J. Scarify general subgrade soils in place to a depth of 6 to 8 inches and compact to minimum of 95 percent of Standard Density for lawn areas, with a moisture content adjusted to +1 to +4 percentage points above optimum, in accordance with ASTM D698.

3.03 EXCAVATION

A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the construction of forms. All excavation shall be unclassified as required regardless of the condition or type of material encountered, including rock.
   1. Cut areas accurately to the indicated cross-sections and grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.
   2. Finish the excavating required for graded areas to a tolerance of one inch above or below the rough grade.
   3. Remove underground obstructions except for piping and conduit.
B. Over cut planting and lawn areas to allow a layer of topsoil 6"-8” thick.
C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.
D. Exercise extreme care in grading around existing trees. Do not disturb existing grades around existing trees except as otherwise noted. When excavation through roots is necessary, and after review by Landscape Architect, perform by hand and cut roots with sharp axe, prune trees to compensate for root loss.
E. Fill over-excavated areas under structure bearing surfaces in accordance with Architect's direction.
F. Do not allow construction equipment to create "pumping" of soils.
G. Stockpile excavated clean fill for reuse where directed. Remove excess or unsuitable excavated fill from site.
H. Over excavate existing soils in saturated conditions. Stockpile wet material. Allow drying out to take place. Mix stockpiled materials with relatively dry onsite material before re-compacting.

3.04 WASTING

A. Surplus excavated material not suitable or required for embankment fill and backfill shall be wasted off site in a safe and legal manner.

3.05 FILL AND BACKFILL

A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.
   1. Complete stripping and wasting operations in advance of fill construction. Proof roll, compact, and establish moisture content.
   2. Deposit and mix fill material in horizontal layers not more than 8" deep, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
   3. Fill material shall have a moisture content between -2 to +3 percentage points of optimum moisture content, to achieve specified compaction. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.
   4 Exercise care to prevent movement or breakage of walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.
   5. Proof roll exposed subgrade in building and paving areas with heavily loaded dump truck or similar acceptable construction equipment, to detect unsuitable soil conditions. Commence proof rolling operations after a suitable period of dry weather to avoid degrading acceptable subgrade surfaces. Make four passes over each section with proof rolling equipment, with the last two perpendicular to the first two.
   6. Cut out soft areas of subgrade not readily capable of in- situ compaction. Backfill and compact to density equal to requirements for subsequent backfill material.

B. Backfilling: Construct compacted fill against and around concrete beams below finish grade.
   1. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.
   2. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
   3. Bring backfill to required grades by depositing material in horizontal layers not more than 8" deep, loose measurement.
   4. Site backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
   5. Maintain optimum moisture content of backfill materials to attain required compaction density.
   6. Make gradual changes in grade. Blend slopes into level areas.

3.06 COMPACTION

A. Compact each layer of earth fill and backfill thoroughly and evenly until there is no evidence of further compaction and a solid and uniform density is secured.
   1. Scarify the subgrade soil of pavement areas to a minimum depth of 6 inches, water and recompact. Soil moisture should be adjusted to +1 to +4 percentage points above their optimum moisture content and compacted to minimum of 95% of their maximum dry density per ASTM D698 (Standard Proctor). Scarify general subgrade soils in place to a depth of 6 to 8 inches and compact to minimum of 95

percent of Standard Density for lawn areas, with a moisture content adjusted to +1 to +4 percentage points above optimum, in accordance with ASTM D698.

2. Equipment for compacting shall be sheep's foot and rubber tired rollers or other compactors capable of obtaining the required density. Compact the fill with power tampers and by hand in areas not accessible to rollers.
3. Compact each layer of fill to the density listed below as a function of the location. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
   a. Material under paving----------95% minimum.
   b. Material under lawn areas----------95% to 100%.

3.07 GRADING

A. Site Grading: Shape and finish earthwork to bring the site to the finish grades and elevations shown on the drawings.
   1. Establish grades by means of grade stakes placed at corners of units, at abrupt changes of grade, and elsewhere as may be required.
   2. Rough grade for paving, and site improvements to the subgrade elevations required. Soft and unstable material which will not readily compact when rolled or tamped shall be removed and the resulting depressions filled with stable material and re-compacted.
   3. Finish grade to the finish contours and spot grades shown. Extend cuts and fills to feather out beyond the last finish contour or spot grade shown. Grade to uniform levels and slopes between points for which elevations are given, round off abrupt changes in elevation, and finish off smoothly. Finish grades shall slope away from the building in all directions to assure proper drainage.
   4. Execute erosion control measures in accordance with the Erosion Control Plan.

B. Grading Around Trees: Where grading is required within the branch spread of trees that are to remain, perform the work as follows:
   1. When trenching occurs, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by hand digging.
   2. When the existing grade at a tree is below the new finished grade, and fill not exceeding 6" is required, clean washed gravel graded from 1" to 2" size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of l8" and finish approximately 2" above the finished grade at the tree. Install gravel before earth fill is placed.
   3. Trees in areas where the new finished grade is to be lowered shall have re-grading work done by hand to elevation as indicated. Existing grades immediately surrounding the trunk shall not be altered except at the direction of the Architect.

C. Field Grading: Fine grading for all athletic fields (competition & practice) shall be established using a laser grader.

3.08 PROTECTION, CLEAN-UP AND EXCESS MATERIALS

A. Protect grades from construction and weather damage, washing, erosion and rutting, and repair such damage that occurs.

B. Correct any settlement below established grades to prevent ponding of water.

C. At locations where concrete or other foreign matter has penetrated or been mixed with earth, remove damaged earth and replace with clean material.

D. Remove excess stockpiled material, debris, waste, and other material from site and leave work in clean finished condition for final acceptance. Contractor is responsible for disposal of debris and excess materials in a safe and legal manner.

3.09 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the select fill material under the building pad and paving shall be performed by an Independent Testing Laboratory.

1. Testing laboratory shall make one in place density test for each 5000 sq. ft. of area per lift, but in no case less than two tests to insure that the specified density is obtained.
2. The cost of the full-time inspection service shall be by Owner.

3.10 CONSTRUCTION STAKING

A. All drives must be staked using the profiles provided in the plans in addition to the grading and dimensional control plans. The contractor shall stake all vertical curves and points of grade break in order to achieve a smooth and uniform grade throughout. Verify all grades and elevations to confirm that ADA parking spaces, walks and ramps are per plans.

END OF SECTION

SECTION 31 1100
CLEARING AND GRUBBING

PART 1 – GENERAL

A. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions.

1.01 SCOPE

A. This section pertains to the specifications for clearing and grubbing, topsoil removal and stockpiling, disconnecting, capping or sealing, and abandoning site utilities in place, and disposal of all vegetation, rubbish and excess material, as required for site grading and related staging areas as noted on the drawings and in accordance with these specifications. Protecting any existing trees, shrubs, groundcovers, plants and grass to remain shall be dictated by Section 02 4120 Selective Demolition.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.
B. Section 02 4120 Selective Demolition
C. Division 02 Section “Existing Conditions” for demolition of buildings, structures, and site improvements.
D. Section 31 2213 Site Grading
E. Section 31 2513 Erosion and Sedimentation Control
F. Section 31 2300 Excavation and Fill
G. Section 32 9113 Soil Preparation
H. Section 32 9120 Topsoil Placement and Grading
H. Section 32 9223 Sodding

1.03 DEFINITIONS

A. Topsoil: See Section 32 91 13 Soil Preparation
B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.
C. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
D. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner’s representative. Unauthorized excavation, as well as remedial work directed by the Owner’s Rep shall be at the Contractor's expense.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 SUBMITTALS

A. Photographic and/or digitally recorded documentation, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements must be prepared. Unless otherwise documented, any damage discovered to trees, plantings, and site features denoted to remain, will be considered the responsibility of the contractor to correct. The owner may at his/her discretion request such photographs and/or video tapes be submitted at any time.

B. Record drawings, according to Division 01, identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated on drawings to be salvaged and store on Owner's premises where indicated. Contractor to contact Owner’s representative for coordination.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place

D. Utility Locator Service: Contact Atmos Energy at 811 for Dig Test for area where Project is located before site clearing.

E. General site narrative – Design & construction of foundations, paving & installation of two (2) Concessions Buildings.

F. Staging Areas - Approval must be obtained from the Owner to use any area for staging that is not specifically identified as such on the plans. The Contractor shall restore all areas used for staging, the extent of said restoration to be defined by the Owner upon granting approval for the use of said area for staging.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section 32 9120 Topsoil Placement & Grading.
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

C. Locate and clearly flag trees and vegetation to remain or to be relocated

D. Control dust and noise, perform work in accordance with requirement of authorities having jurisdiction. No explosives are permitted. No on-site burning is permitted.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures per Civil Site Requirements of ”Erosion and Sedimentation Controls”.

B. Provide measures according to a sediment and erosion control plan, specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal

3.03 TREE PROTECTION (NOT USED)

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed

1. Arrange with utility companies to shut off indicated utilities. Contractor is responsible for any service charge required for shut-off action. If other outstanding fees or billings are encountered, the Contractor shall notify the Owner's representative for direction.

B. Known utilities are shown on drawings. If utility discovered that is not shown contact Owner's representative for direction. Do not interrupt unknown utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner's representative not less than two weeks in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

3.05 CLEARING

A. Construction - That portion of the site required for constructing the work under these specifications shall be cleared of all vegetation, such as trees, brush, grass and weeds and all other objectionable matter to the limits as depicted in the plans. Stumps and roots shall be completely removed.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.06 STRIPPING

A. Topsoil stripping:

1. Remove sod and grass before stripping topsoil.
2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. A minimum of six (6) inches of soil shall be stripped. This must be verified with the geotechnical report provided by the owner for this project. If discrepancy, review with Owner prior to start of work.
   a. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
3. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   a. Limit height of topsoil stockpiles to 72 inches. Coordinate with the owner, contractor, and project conditions to ensure that this height is appropriate.
   b. Do not stockpile topsoil within tree protection zones.
   c. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

4. Strip man-made fills under structures and pavements to minimum 12” below the ground surface and dispose of all waste materials.

B. At all times during clearing and stripping operations the area shall be kept in a manner to prevent ponding. Refer to measures per Civil Site Requirements of ”Erosion and Sedimentation Controls”.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.08 DISPOSAL

A. Disposal of cleared materials - Subject to approval of the Owner, material from clearing operations shall be disposed of by removal from the worksite.

1. Disposal of Material by Removal
   a. Material disposed of by removal from the construction area shall be removed from the areas prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.
   b. Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the Contractor.
   c. In hauling any material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site or area streets and roads. The Contractor shall promptly remove any debris which falls from vehicles.
   d. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities

3.09 STOCKPILING

A. All topsoil from the stripping operations shall be stockpiled in the areas so designated on the drawings. Materials shall be deposited and spread in such a manner to ensure proper drainage and prevent severe erosion of the stockpile.

B. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

END OF SECTION

SECTION 31 2300
EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SYSTEM DESCRIPTION

A. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on drawings or reasonably necessary for performance of Work.

B. Contractor is responsible for design of temporary earth retention systems.

1.02 SUBMITTALS

A. Test Reports: Submit 2 copies of the field density test reports directly to the Architect from the testing services, with a copy to the Contractor and a copy to the structural engineer.

1.03 QUALITY ASSURANCE

A. For trench excavation which exceeds a depth of five feet, the Contractor shall submit to the Owner detailed drawings and specifications for adequate safety systems that meet Occupational Safety and Health Administration standards prepared and sealed by a qualified registered engineer. Costs for this work shall appear as a line item in the "Schedule of Values". These drawings and specifications will be reviewed for compliance with OSHA standards by an independent registered engineer employed by the Owner.

1.04 PROJECT CONDITIONS

A. Storm Water Management: Contractor shall perform construction operations in accordance with best management practices to control pollutants in storm water discharges during construction. Contractor shall conform to requirements for pollution prevention and control measures required by TCEQ (Texas Commission on Environmental Quality). Execution of the Pollution Prevention and the Pollution Control Plan shall meet all requirements set forth by TCEQ under the Texas Pollution Discharge Elimination System (TPDES). The SWPPP document (including N.O.I. and N.O.T.) That makes up the balance of the SWPPP shall be prepared by the contractor at his expense. The contractor shall be the Owner/Operator of the SWPPP and responsible for executing and filing the N.O.I. and N.O.T. and paying all fees required by TCEQ.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-expansive Select Fill: Non-expansive select fill shall be a very sandy clay or clayey sand with a liquid limit (LL) of less than 35, a plasticity index (PI) between 4 and 15, and a minimum dry unit weight of 110 pcf.

B. Sand: Natural river or bank sand, washed, free from silt, clay, loam, friable or soluble materials, and organic matter.

C. Common Fill: Reused site or imported soils free from trash, debris, roots over 1 inch in diameter, matted roots, rocks over 3 inches in diameter, topsoil, and other deleterious matter.

PART 3 - EXECUTION

3.01 EXCAVATING

A. Excavate to grades and subgrades indicated. Make excavations large enough to permit placing and inspection of work.

B. Stockpile excavated materials that are suitable for reuse separately from subgrade material.

C. Remove and dispose of excavated material that is unsuitable or not required for backfilling. Remove underground obstructions.

D. Brace sides of excavations where necessary; maintain until permanent construction is in place. Remove temporary shoring and bracing as backfill is placed.

E. Excavation for Structures:

1. Form bottoms of excavations reasonably level.

2. Maintain moisture level in excavations as near their natural level as possible.

F. Correct over-excavation under footings by use of lean concrete. Correct other over-excavation by use of non-expansive select fill, compacted to density of existing subgrade.

G. Keep excavations free of water.

3.02 ROCK CLAUSE

A. If material is so large, heavy or cumbersome that it cannot be removed with a John Deere 455 Loader-Backhoe, then that part of excavation that requires other methods of removal such as, but not limited to, pneumatic jack hammer, hydraulic rock breaker, or dynamite, will be billed on a time and material basis less the cost for removal by normal means.

B. Some work done during the rainy season may cost more than summer time work. This should be clearly understood prior to commencement of work. Said projects may include but are not necessarily limited to, removing a roof over a finished space or soil excavation.

C. Post hole excavation is typically accomplished with hand tools. In the event any obstructions are encountered, natural or otherwise, additional labor, equipment rental and/or materials required to remove the obstruction, such as but not limited to, jack hammer, two-man auger or drill rig, etc., may be billed on a time and materials basis or may incur increased costs.

D. Drilling - Due to the fact that the conditions below the surface cannot be seen, certain assumptions are made in order to provide an estimate of cost. What follows is a list of circumstances that may alter the cost and how it will be billed should such circumstances arise:

a. Obstruction time shall be charged for drilling time or delay time due to any sub-surface obstruction other than natural geological formation.

b. In the event that caving soils, sub-surface water, hard-rock, etc., conditions (drilling refusal) prohibits us from performing the job in a normal manner (using our rock auger equipment), the work will stop. Any additional work requested by the engineer beyond that point will be done pursuant to Change Order. Drilling refusal: less penetration than 1 inch in 5 minutes.

c. In the event that drilling refusal is encountered before assumed drill depth, the footage we are short times the deduct price shall be deducted from the contract price. Any additional drilling beyond that point, if required, will be done pursuant to Change Order.

d. The add/deduct unit prices for any individual drilled shaft shall apply only when the variation from plan length does not exceed 15%. Any increase/decrease in excess of such amount shall be performed pursuant to Change Order.

3.03 FILLING

A. Fill low areas outside of structures and under paving with common fill to achieve required grades and elevations.
   1. Place fill in maximum 9 inch deep loose, even, horizontal lifts.
   2. Fills Outside Modified Areas: A minimum of 95% maximum standard Proctor dry density (ASTM D 698) at a minimum of +2 percentage points above optimum moisture content.
   3. Pavement Subgrade: A minimum of 95% maximum dry density as determined by ASTM D 698 at a moisture content within -1 to +4 percentage points of optimum.

B. Fill under structures with non-expansive select fill.
   1. The first lift of select fill shall be placed wet of optimum to prevent drying the underlying subgrade.
   2. Place fill in maximum 9 inch deep loose, even, horizontal lifts.
   3. Compact each lift to a minimum of 95% maximum standard Proctor dry density (ASTM D 698) in the range of -2 to +3 percentage points of optimum moisture content.

C. Do not fill over porous, wet, frozen, or soft subgrades.

D. Bench fill into slopes.

E. When moisture must be added to aid in compaction, uniformly apply water to surface, but do not flood. Free water shall not appear on surface during or after compaction operations.

F. Scarify soil too wet for proper compaction and allow to dry. Replace and recompact.

G. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level grades.

H. Tolerances: Within plus or minus 1 inch of required subgrade elevation.

3.04 TRENCHING

A. Cut trenches sufficiently wide to allow for installation of utilities and for inspection of work.

B. Hand trim excavations; remove loose matter.

C. Remove rocks and obstructions.

D. Correct over-excavation by use of lean concrete or pipe bedding material.

E. Keep trenches free of water.

3.05 BACKFILLING

A. Backfill under structures with common fill.
   1. Place backfill in loose, even, horizontal lifts maximum 9 inches deep.
   2. Compact to a minimum of 95% maximum standard Proctor dry density (ASTM D 698) in the range of -2 to +2 percentage points of optimum moisture content.

B. Backfill outside of structures and under paving with common fill.
   1. Place backfill in loose, even, horizontal lifts maximum 9 inches deep.

2. Backfill for Exterior Face of Grade Beam: A minimum of 92% maximum standard Proctor dry density (ASTM D 698) at a minimum of +5 percentage points above optimum moisture content.

3.06 FIELD QUALITY CONTROL

A. Testing and Inspection Services: Perform field in place density tests, ASTM D 2922, at following rates; minimum of three tests for each lift or area:

1. Under structures: One test for each 3,000 square feet, per lift; a minimum of 3 tests per lift.
2. Under paving: One test for each 10,000 square feet, per lift.
3. Trenches and grade beam backfill: One test for each 100 linear feet, per lift.

3.07 CLEANING

A. Remove surplus materials and those not suitable for reuse from site.

3.08 PROTECTION

A. Protect graded areas from traffic and erosion; keep free of trash and debris.

END OF SECTION

SECTION 31 3116
TERMITE CONTROL

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 - Submittal Procedures. Include application instructions.

1.02 QUALITY ASSURANCE

A. Applicator Qualifications: Licensed for termite control in State of Texas.

1.03 DELIVERY, STORAGE AND HANDLING

A. Protect containers from accidental opening and use.

1.04 PROJECT CONDITIONS

A. Do not apply termiticide when surface water is present.

1.05 WARRANTIES

A. Provide 5-year warranty against invasion or propagation of subterranean termites and damage to building or building contents caused by termites, including repairs to building and building contents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Products/Manufacturers:
   1. Equity; 1.0% in water emulsion.
   2. Permethrin (Dragnet, Torpedo); 0.5% in water emulsion.
   3. Bifen I/T; 0.06% in water emulsion; Control Solutions, Inc.
   4. Telstar P; 0.12% in water emulsion; FMC Corp.
   5. Cyper TC; 1.0% in water emulsion; Control Solutions, Inc.
   6. Premise Pro; Bayer Environmental Science

2.02 MIXES

A. Mix materials in accordance with manufacturer’s written instructions.

PART 3 - EXECUTION

3.01 APPLICATION

A. Apply materials in accordance with manufacturer's instructions.

B. Spray apply treatment at minim um rates recommended by manufacturer.

C. Apply treatment to areas beneath floor slabs, structures, and outside of building perimeter.

D. Saturate areas around floor slab penetrations.

E. Prevent spillage and runoff onto adjacent non-treated areas.

F. Ensure complete coverage of treated areas.

G. Extend treatment onto adjacent construction and floor slab penetrations.

H. Reapply termiticide to treated soils that are disturbed after treatment.

END OF SECTION

SECTION 31 6329
DRILLED CONCRETE PIERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes
   1. Drilling and cleaning pier holes
   2. De-watering of shafts and removal of spoil
   3. Casing pier holes

B. Products Installed, Not Furnished Under This Section
   1. Concrete and reinforcing steel
   2. Anchor bolts, templates and dowels

1.02 REFERENCES (Latest Edition)

A. Codes and Specifications
   1. Standards and specifications provided by the Association of Drilled Shaft Contractors
   2. American Concrete Institute (ACI):
      a. ACI 336.1, Specification for the Construction of Drilled Piers
      b. ACI 336.3, Report on Design and Construction of Drilled Piers

1.03 BASIS FOR BIDS

A. Definitions
   1. Ground surface: Final grade based on finish floor elevations in Contract Documents.
   2. Pier depth: Total depth of pier calculated as the sum of:
      a. Depth from ground surface to top of bearing stratum
      b. Depth that casing extends into bearing stratum
      c. Required penetration into bearing stratum
   3. Bid depth: Pier depth based on top of bearing stratum elevation in Contract Documents.
   4. Pay depth: Actual depth of pier as installed.

B. Contract Sum
   1. Calculate Contract Sum based on bid depth.
   2. Include temporary casing in Contract Sum.

C. Unit Prices
   1. Piers: provide add and deduct unit price per linear foot shorter or longer than bid depth
      a. Above bearing stratum
      b. Within bearing stratum.
      c. No additional depth of penetration into bearing stratum will be included in the pay depth unless required in writing by the inspecting agency.
   2. Casings: provide add and deduct unit price per linear foot for steel casing installation and removal. Base unit price on actual length of temporary steel casing measured from ground surface to bottom of casing.
   3. Provide unit prices for complete Work including labor, materials, overhead, taxes and profit.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Contractor: at least 3 years of experience in similar applications
      a. Relevant experience to anticipated subsurface materials, water conditions, shaft sizes and special techniques required
   2. Demonstrate to Architect dependability of equipment and techniques to be used, when requested.

B. Conform to requirements of ACI 336.1, except as modified by requirements of this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store reinforcing cages off ground and protect from contamination by dirt, grease and corrosion.

B. Deliver concrete to site in timely manner and in sufficient quantities to allow concreting of each pier as monolithic unit.

C. Coordinate delivery of concrete to allow placement to begin within 4 hours of completion of drilling.

PART 2 - PRODUCTS

2.01 MATERIALS - Refer to related sections for materials installed, not furnished under this section.

2.02 FABRICATION

A. Prior to drilling pier holes, fabricate reinforcing cages in stock lengths suitable for cutting to required lengths. Bend reinforcing as detailed.
   1. Do not splice vertical reinforcing within top 10 feet of pier.
   2. Except as otherwise required, vertical reinforcing may be spliced with a Class B tension splice. Lap and tie bars at splices.
   3. Do not use cross wire ties that would interfere with tremie pipe or concrete free falling down the center of the cage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation, review subsoil investigation report for site provided by Owner and become thoroughly familiar with anticipated subsoil conditions.

B. Examine site for obstructions to drilling, such as power lines, utilities, material stockpiles, boulders and uneven surfaces. Report anticipated problems to Architect in timely manner so as not to delay schedule of Work.

C. Locate existing underground utilities and notify Architect of conflicts with Work.

3.02 PREPARATION

A. Have ready at site equipment anticipated to be necessary for successful installation of piers, including power augers, core barrels, tremies, hoppers, chutes, and casing, as applicable.

B. Maintain in ready condition dowels, templates, and anchor bolts required for pier installation.

3.03 INSTALLATION

A. Drilling Straight Shaft Pier Holes
   1. Drill pier holes with power augers or core barrels suitable for subsoil conditions at site.
   2. Drill pier holes of required diameters to bearing stratum and penetrate bearing stratum to required depths below top of stratum.
   3. Where casing is required, increase pier hole diameter as necessary to accommodate casing having inside diameter not less than required shaft diameter to depth necessary to seal shaft.
   4. Where casing is required, measure required depth of penetration into bearing stratum from top of stratum or from bottom of casing, whichever is deeper from ground surface.

B. De-watering Pier Holes
   1. Remove standing water from pier holes to within 3 inches of hole base by bailing or pumping.
   2. Where flowing water is encountered, or required water level cannot be maintained, use casing.

C. Casing Pier Holes
   1. Where flowing water or caving soil is encountered use temporary steel casings to seal sides of shaft.
   2. Provide watertight, steel casings of adequate strength to withstand handling stresses and concrete and earth pressures.
   3. Extend casings only to depth required to seal off water or caving soil.
   4. Extract casings in vertical lifts, maintaining adequate head of concrete to prevent caving of soils. Do not rotate casing during removal.

D. Placing Reinforcing Cages, Dowels and Anchor Bolts
   1. Place reinforcing steel cages accurately in shafts and hold in position during placement of concrete.
   2. Place dowels and anchor bolts in position and maintain proper location and elevation with templates.
   3. Use spacer rollers to maintain position of cage within shaft and to maintain minimum 3 inches of concrete cover. Where casing is required, maintain 4” of cover to pier reinforcing.
   4. Use end blocks to support cage at required elevation maintaining proper clearance at base of pier.

E. Placing and Consolidating Concrete
   1. Clean pier shafts of accumulated loose material before placing concrete and remove water to within 3 inches of base of shaft.
   2. Place concrete within 4 hours of drilling.
   3. Place concrete using collection hopper with steel outlet pipe to direct concrete down the center of the shaft. Placing concrete directly into the shaft from concrete truck chute is not allowed.
   4. Extend tremie pipe as required to limit concrete free fall height as follows:
      a. Shaft diameter 18 inches or less: 10 feet max free fall
      b. Shaft diameter 20 to 30 inches: 30 feet max free fall
      c. Shaft diameter 32 inches or larger: 60 feet max free fall
   5. Place concrete in one continuous operation for each pier.
   6. Consolidate top 6 feet of each pier with concrete vibrator.
   7. Where water rises to top of pier during placement, remove over-wetted concrete and replace with sound, dense material.
   8. Remove and replace portions of concrete that become contaminated with mud or spoil material during placement.
   9. Where tops of pier holes become mushroomed during drilling or installation procedures, use round forms to maintain constant diameter.

F. Tolerances
1. Maximum lateral variation off centerlines: 3 inches
2. Plumbness of vertical piers within 1 ½ percent of shaft depth to bearing stratum.
3. Shaft diameter: plus 2 inches, minus 0
4. Top of pier elevation: plus one inch, minus 3 inches
5. Penetration into bearing stratum: minus 0, plus 1 foot.
6. Levelness of pier bottom bearing surface: within 1 vertical to 12 horizontal of level
7. Placement of dowels at tops of piers: plus or minus 1 inch horizontal and vertical. Set dowels in open shaft prior to concrete placement, unless wet setting of dowels is approved by Architect.
8. Placement of anchor bolts: plus or minus ¼ inch horizontal, plus or minus ½ inch vertical.

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory and Inspection Services
1. Inspect drilling of each pier hole
   a. Determine location of required bearing stratum
   b. Measure depth to bearing stratum from ground surface
   c. Measure overlap of casing into the bearing stratum where casing required.
   d. Measure depth of penetration into stratum
   e. Measure shaft diameters.
   f. Measure casing diameter where casing required
   g. Inspect condition of base prior to placing concrete
2. Inspect reinforcing cages
   a. Check bar sizes and quantity
   b. Check tieing and splicing of cages
   c. Monitor placement and securement techniques
3. Monitor concrete placement
   a. Monitor time interval between drilling and placement.
   b. Inspect placement techniques and conditions.
   c. Inspect concrete quality at tops of shafts.
4. Material Tests: refer to sections for products installed, not furnished under this section.
5. Field Conditions: where un-anticipated subsurface conditions prevent proper installation of piers, do not proceed with Work until directed by Architect.
6. Pier Log: for each pier record the following and submit to Architect for review:
   a. Identification mark
   b. Plan view identifying pier location
   c. Shaft diameter
   d. Top of bearing stratum elevation
   e. Bottom of pier elevation
   f. Penetration of bearing stratum
   g. Pier reinforcing (vertical bars and ties)
   h. Steel cage length
   i. Depth and diameter of casing, where casing required
   j. Top of Pier Elevation

k. Concrete quantity

l. Date and time drilling completed

m. Date and time concrete placement begun and completed

n. Plumbness variation

o. Condition of drilled hole before placement of concrete

p. Notes regarding piers not in compliance with Contract Documents

B. Adjusting

1. Re-drill piers for which time lapse between drilling and concreting exceeds maximum as determined by Architect at no additional cost to Owner.
2. Replace piers installed without required inspection as directed by Architect at no additional cost to Owner.
3. Test and/or correct pier installations suspect of deficient quality as directed by Architect at no additional cost to Owner.
4. Pier shafts larger than required diameter, except where casing is required, may require additional vertical reinforcing, as instructed by Architect at no additional cost to Owner.
5. Remove mushrooms - before concrete cures, remove excess concrete from tops of piers to maintain pier shafts of constant diameter.

C. Clean-up

1. Remove spoil and debris from the site and legally dispose.

END OF SECTION

SECTION 32 1726
TACTILE WARNING SURFACING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Samples: Submit in accordance with Section 01 3300 - Submittal Procedures. Submit 3 x 3 inch tile samples in specified color.

1.02 QUALITY ASSURANCE

A. Products and Installation: Conform to applicable accessibility code.

B. Installer Qualifications: Minimum 2 years documented experience in work of this section.

1.03 PROJECT CONDITIONS

A. Environmental Requirements: Do not install tiles when surrounding air or substrate surface temperature is below 40 degrees F or above 90 degrees F during or 48 hours after completion of the work.

1.04 WARRANTY

A. Submit manufacturer's standard 5-year warranty against defective work, breakage, deformation, fading, and loosening of tiles.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Provide Access Tile Engineered Polymer Composite Surface Applied Detectable/Tactile Warning Tile as manufactured by Access Products, Inc. (phone888.679.4022 web site: www.accesstile.com). Color shall be Brick Red.

2.02 MATERIALS

A. Engineered Polymer Composite Surface Applied Detectable/Tactile Warning Tiles shall be manufactured from an ultra violet stabilized polymer composition with fiberglass reinforcement, the tile shall incorporate an in-line pattern of truncated domes measuring nominal 0.2" height, 0.91" base diameter, and 0.45" top diameter, spaced center-to-center 2.35" as measured side by side.

1. Dimensions: Surface Applied Detectable/Tactile Warning Tiles shall be held within the following dimensions and tolerances; Length and Width: 24" x 60" (+/- 0.5").
2. Compressive Strength of Tile when tested by ASTM D 695 not to be less than 25,000 PSI.
3. Tensile Strength of Tile when tested by ASTM D 638 not to be less than 12,500 PSI.
4. Flexural Strength of Tile when tested by ASTM D 790 Procedure A not to be less than 30,000 PSI.

2.03 ACCESSORIES

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor; 1/4" diameter x 1-1/2" long as supplied by Access Products, Inc.

B. Adhesive: Type recommended by tile manufacturer.

C. Cleaner: Type recommended by tile manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Surface to receive tile shall be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. Clean this area with a clean rag soaked in Acetone.

B. Prior to installing tiles, ensure that surface is clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers, and surface has cured for a minimum of 30 days.

3.02 INSTALLATION

A. Install detectable I tactile warning tile in strict accordance with manufacturer's written instructions and recommendations.

3.03 CLEANING, PROTECTION, AND MAINTENANCE

A. Protect tiles against damage during construction period.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project.

END OF SECTION

SECTION 32 1900
WALK, ROAD, AND PARKING APPURTENANCES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 3300 – Submittal Procedures. Include catalog, cuts of each type of sign and manufacturer's installation instructions.

1.02 WORK INCLUDED

A. Provide and install handicapped parking signs and traffic directional signs.

B. Provide precast concrete wheel stops

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 591 Steel Sheet, Cold-Rolled, Electrolytic Zinc- Coated.
   2. ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM C 33 Concrete Aggregates
   4. ASTM C 150 Portland Cement

B. Military Specifications (Mil. Spec.):
   1. Mil. Spec. MIL-R-13689A

1.04 PROJECT CONDITIONS

A. Coordinate installation of signs with work of other trades.

B. Location of signs shall be in accordance with City and State requirements. Signs shall be positioned not to conflict with automobile or pedestrian traffic.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle signs in accordance with Section 01 6000 – Product Requirements, and in manufacturer's cartons. Store off ground on planking. Cover with non-staining plastic.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Site signs: As manufactured by Sa-So (Sargent-Sowell, Inc.) 1185 108th Street, Grand Prairie, Texas 75050 (phone 647-1525), or approved equivalent.

2.02 MATERIALS

A. Sign Materials:
   1. Aluminum Sheets: ASTM B 209, alloy 6061 T6, degreased and etched, 0.080" thickness. Sign faces shall be fully reflectorized with material conforming to Mil. Spec. MIL-R-13689A.

B. Bolts, Nuts, Washers, and Clamps: Cadmium or galvanized steel. Bolts shall be a minimum of 5/16" in diameter. Clamps shall be two-piece assemblies of at last 14-gage steel or shall be an adjustable steel strap bracket.
C. Posts: Standard galvanized steel pipe 2-3/8" in diameter and weighing not less than 2 lbs. per linear foot.
D. Concrete: Provide concrete consisting of Portland cement (ASTM C 150), aggregates (ASTM C 33), and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi, using at least 4 sacks of cement per cubic yard, 1 inch maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

2.03 SITE SIGNS

A. General: Site signs shall be of the quality manufactured by Sa-So and are listed by Sa-So catalog numbers for convenience in identification.
B. Accessible Parking Signs: Reflective .080 Aluminum.
C. Accessible Loading Zone Sign: Reflective .080 Aluminum.
D. Traffic Signs: As indicated on the drawings and in accordance with the local requirements of the local jurisdiction. Reflective sheeting on 0.080" aluminum.

2.04 PRECAST CONCRETE WHEEL STOPS

A. Qualities: Precast concrete parking wheel stops reinforced, and having 2 pre-drilled pin holes and having 2 cast-in anchor pins.
   1. Concrete: Normal weight concrete, minimum 4000 psi 28-day compressive strength.
   2. Reinforcing: 2 continuous No. 3 deformed reinforcement bars.
   3. Size: 8-1/2 inch wide by 6 inch high by 72 inch length.
   4. Anchor Pins: 5/8 inch deformed bar, 2 for each wheel stop, extending a minimum of 3 inches below bottom of wheel stop.
B. Standards
   1. Concrete: ASTM C 94.
   2. Reinforcing: ASTM A 615, Grade 40.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Posts and Signs:
   1. Excavation: Drill holes of the size indicated for posts. Excavate holes to the depths indicated. Remove excess concrete and excavated soil from the site.
   2. Setting Posts:
      a. Remove all loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete. Center and align posts in holes.
      b. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Trowel finish tops of footings, and slope or dome to direct water away from posts.
   3. Attach signs to posts with bolts, washers, nuts and clamps.
   4. Clean exposed sign faces and galvanized surfaces, and leave free of defects. Use no abrasives. Leave pavement and graded area clean and free of debris.

B. Precast Concrete Wheel Stops:

1. Preparation:

a. Verify layout of parking bumper locations with pavement marking layout.

b. Thoroughly clean surfaces to receive parking bumper free of dirt, sand, oil, grease or other foreign matter.

2. Installation:

a. Install a precast parking bumper in each parking space indicated on drawings.

b. Install with anchors in accordance with manufacturer's instructions.

c. Leave parking bumper securely anchored and in proper alignment.

END OF SECTION

SECTION 32 3119
ALUMINUM ORNAMENTAL FENCES & GATES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 3300 - Submittal Procedures. Include details of fence height, sizes of all components, footings, and accessories.

B. Product Data: Provide material specifications, characteristics, and instructions for installation.

C. Shop Drawings: Show fabrication and installation details for the ornamental aluminum. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

1. Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.

D. Samples: Submit two samples, 12 inch length illustrating each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of gate components and systems with requirements based on comprehensive testing of current products.

G. Provide copy of all written warranties specified in this specification section, including aluminum finish.

1.02 QUALITY ASSURANCE

A. Ornamental aluminum gate components to comply with the International Building Code.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Installer Qualifications: Engage an experienced Installer who has successfully completed aluminum fence of same materials and extent to that indicated for Project.

D. Welder Qualifications: Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1. AWS D1.2, "Structural Welding Code--Aluminum."

E. Field-Constructed Mock-Up: Before installing the work of this section, erect mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

1. Locate mock-ups on site in location and size indicated or, as directed by Architect.
2. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work. Minimum length of mock-up shall be 6 feet.
3. Obtain Architect's acceptance of mock-ups before start of metal gate fabrication.

1.03 COORDINATION

A. Coordinate installation of anchorages for the ornamental aluminum fence and gates. Furnish setting drawings, templates, and directions for installing anchorages, including 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.

B. Field Measurements: Where ornamental fence and gates is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store ornamental fence and gates inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by sufficient excelsior to ensure that products will not be cracked or otherwise damaged.

1.05 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Submit written agreement on aluminum ornamental fence (and gate) manufacturer’s standard form, signed by manufacturer, installer, and contractor, agreeing to repair or replace defective materials that do not comply with these specifications for a minimum one (1) year from date of Substantial Completion and Owner Final Acceptance.

C. Special Finish Warranty for Fluoropolymer Two-Coat System: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Ten (10) years from date of Substantial Completion and Owner Final Acceptance.

PART 2 - PRODUCTS

2.01 FABRICATORS

A. Materials are specified by brand names to establish a basis for quality and design, or by performance requirements and general description of product. The Architect will consider substitutions for brand names of products specified, provided the procedures set forth for substitutions are followed. The Architect reserves the right to reject any material which, in his opinion, will not produce the quality of the work specified herein.

B. Manufacturers offering products which may be incorporated in the work, include, but are not limited to the following:

1. Ameristar (800) 321-8724 www.ameristarfence.com
2. Ametco Manufacturing Company (800) 362-1360 www.ametco.com
3. Edko, Inc. (888) 800-3356 www.edko.com

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.
   1. Extruded Posts: ASTM B 221, 6061-T6.
   2. Extruded Bar and Shapes: ASTM B 221, 6063-T5/T52.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.03 COMPONENTS

A. Rails and Posts: square tubing sizes, as indicated in the drawings.

B. Fittings: Elbows, Tee-shapes, wall brackets, escutcheons; machined aluminum.

C. Pickets: square extruded tubing, as indicated in the drawings.

D. Mounting: Brackets and flanges, with steel inserts for casting in concrete.

E. Splice Connectors: Concealed spigot; machined aluminum.

F. Finish for Exposed Aluminum Surfaces: Electrostatically applied thermosetting Kynar fluoropolymer resin coating with inhibitive flash primer over conversion coating. Meet or exceed AAMA 2605 standards. Coordinate shade to match finish on other items specified elsewhere. Submit color samples for approval. Color to be selected by Architect.
   1. Chemical Pretreatment (AA-C12C40R1X): Aluminum shall be cleaned with inhibited chemicals and the surface chemically converted to amorphous chromium phosphate to conform to ASTM D 1730, Type B, Method 5, prior to coating. Conversion coating weight must exceed 40 milligrams/square foot. No substitutions for amorphous chromium phosphate (conversion coat) will be permitted. Nominal coating thickness: 0.25 +/- 0.05 mil.
   2. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat containing not less than 70 percent polyvinylidene fluoride resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions. Provide coating which has been field tested under normal range of weathering conditions for a minimum of 10 years without significant peel, blister, flake, chip, crack, or check in the finish, and without chalking in excess of 8 (ASTM D 4214) and without fading in excess of 5 NBS units.
   3. For concealed conditions, as extruded/ as rolled mill finish is acceptable.

G. Gate Hardware: Stainless steel hinges, double gate latch assembly, and required fittings for operation as a double swing gate. All electronic devices and connections to security equipment are to be selected by Owner.
   1. Provide double cylinder key locks on all gates. Coordinate keying with Door Hardware Supplier.

H. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing

no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187; Karnak 118 Black Asphaltum, Karnak Corp. (800) 526-4236; www.karnakcorp.com or approved equal.

2.04 MISCELLANEOUS MATERIALS

A. Non-shrink, Gypsum-Free, Cement-Based Nonmetallic Grout: Premixed, factory-packaged, Non-staining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. Approval products include, but are not limited to:
   1. Emaco Grip manufactured by BASF (800) 243-6739 www.buildingsystems.basf.com
   2. Super Por-Rok manufactured by Lambert Company www.lambertusa.com
   3. NS Grout manufactured by Euclid Chemical Company www.euclidchemical.com

B. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Fasteners for Anchoring Ornamental Aluminum Fence Components to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring aluminum fence to other types of construction indicated.
   1. Provide fasteners fabricated from Type 304 stainless steel.

D. Fasteners for Interconnecting Ornamental Aluminum Fence Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

E. Cast-In-Place and Post-installed Anchors in Concrete: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

F. Zinc Chromate Primer: FS TT-P-645.

2.05 FABRICATION

A. Verify dimensions on site prior to shop fabrication.

B. Fill and shop assemble sections in largest practical sizes, for delivery to site and installation.

C. Grind exposed welds smooth and flush with adjacent surfaces.

D. Form ornamental aluminum components to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.
   1. Join components by welding, unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.
   3. All welds shall be concealed where possible.

E. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Remove sharp or rough areas on exposed surfaces.

F. Accurately form components required for anchorage gates to adjacent structure.

G. Fabricate joints that will be exposed to weather in a manner to exclude water.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction.

B. Confirm that unfinished concealed aluminum in contact with dissimilar metals, cementitious materials, masonry, and wood has been treated with a protective coating as specified in Part 2 of this specification section.

3.01 INSTALLATION

A. Install in accordance with shop drawings and manufacturer's pre-printed installation instructions.

B. Concrete set posts: Auger drill holes in firm, undisturbed or compacted soil and/or existing concrete or asphalt paving Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 12" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Refer to Section 31 2000 for excavation procedures. Set post bottom 36" below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts.

C. Refer to Structural Drawings and Section 03 3000 for installation of concrete footings and foundations for post support.

D. Gate posts and hardware: Set keepers, stops, sleeves and other accessories into concrete. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

1. Gate posts shall be spaced so that the inside-to-inside spacing equals the sum of the manufacturer's standard as-built end-to-end leaf width(s), plus the clearances required for the specified latching and hinging hardware
2. Adjust hardware for smooth operation and lubricate where necessary.

E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of metal gates. Set accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

F. Corrosion Protection: Coat concealed surfaces of components, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

1. Special care shall be taken to ensure that embedded portion (including cut ends) of aluminum posts are separated from steel reinforcement with bituminous coating.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

H. Weld field connections and grind smooth to complete assembly. Touch-up welds with primer.

3.02 CLEANING AND PROTECTION

A. Cleaning: Clean aluminum in accordance with recommendations of metal finisher in a manner that leaves an undamaged and uniform finish matching approved sample.

B. Protect finishes of gates from damage during construction period by use of temporary protective coverings approved by aluminum fence manufacturer. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

SECTION 32 9113
SOIL PREPARATION

PART 1 – GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Perform soil preparation work as described in Contract Documents.
   2. Furnish and apply soil additives as described in Contract Documents.

1.02 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM 1557-02, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.'

1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data: Product literature & chemical/nutrient analysis of soil amendments & fertilizers.
   2. Samples: Sample of soil conditioner for approval before delivery to site. Include product analysis list.
B. Informational Submittals:
   1. Installer Reports: Delivery slips indicating amount of soil conditioner delivered to Project site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Incorporate following soil amendments into topsoil used for Project. Do not apply additional fertilizer if GroPower Plus soil conditioner is used.
   1. Acceptable Soil Amendments, Soil Conditioners, And Application Rates:
      a. EPA Class 'A' co-compost or compost with SAR less than 3.0, EC less than 4.0, and CN ratio of 15 to 25:1 passing through 1/2 inch mesh screen.
   2. Acceptable Fertilizers & Application Rates:
      a. 2.8 lbs. of 4100 s.f..
      b. 1.4 lbs. of p205/1000 s.f.
      c. Equal as approved by Architect before installation.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Add specified soil amendments at specified rates to lawn areas. Roto-till or otherwise mix amendments evenly into top 4 inches 100 mm of topsoil. Incorporate and leach soil amendments which require leaching, such as gypsum, within such time limits that soil is sufficiently dry to allow proper application of fertilizer and soil conditioners.

END OF SECTION

SECTION 32 9120
TOPSOIL PLACEMENT AND GRADING

PART 1 – GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil placement and grading work required to prepare site for installation of landscaping as described in Contract Documents.
   2. Furnish and apply soil additives as described in Contract Documents.

1.02 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM 1557-02, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.'

1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data: Product literature and chemical / nutrient analysis of soil amendments and fertilizers.
   2. Samples: Sample of soil conditioner for approval before delivery to site. Include product analysis list.

B. Informational Submittals:
   1. Field Quality Control Submittals:
      a. Submit tests on imported and site topsoil by licensed laboratory before use, using ‘Topsoil Test Report.’
         1) Before use, topsoil shall meet minimum specified requirements and be approved by Architect.
         2) If necessary, submit proposed amendments and application rates necessary to bring topsoil up to minimum specified requirements.
      b. Submit report stating location of source of imported topsoil and account of recent use.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil:
   1. Topsoil used in landscaped areas, whether imported or from site, shall be fertile, loose, friable soil meeting following criteria:
      a. Chemical Characteristics:
         1) Acidity / alkalinity range: pH 5.5 to 8.0.
         2) Soluble Salts: less than 3.0 mmhos/cm.
         3) Sodium Absorption Ratio (SAR): less than 6.0.
         4) Organic Matter: greater than one percent.

b. Physical Characteristics:

1) Gradation as defined by USDA triangle of physical characteristics as measured by hydrometer.

a) Sand: 15 to 60 percent.

b) Silt: 10 to 60 percent.

c) Clay: 5 to 30 percent.

2) Clean and free from toxic minerals and chemicals, noxious weeds, rocks larger than 1-1/2 inch 38 mm in any dimension, and other objectionable materials.

3) Soil shall not contain more than 2 percent by volume of rocks measuring over 3/32 inch 1/4 inch in largest size.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not commence work of this Section until grading tolerances are met.

3.02 PREPARATION

A. Protection Of In-Place Conditions: Protect utilities and site elements from damage.

B. Surface Preparation:

1. Disk, till, or aerate with approved agricultural aerator to depth of 6 inches.

2. Seven days maximum before beginning seeding and planting:

a. Loosen area 4 inches deep, dampen thoroughly, and cultivate to properly break up clods and lumps.

b. Rake area to remove clods, rocks, weeds, roots, and debris.

c. Grade and shape landscape area to bring surface to true uniform planes free from irregularities and to provide drainage and proper slope to catch basins.

3. Limit use of heavy equipment to areas no closer than 6 feet 1800 mm from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet.

3.03 PERFORMANCE

A. Tolerances:

1. Total topsoil depth of 5 inches minimum in lawn and groundcover planting areas. No topsoil as defined in this Section required over tree and shrub planting areas.

2. Finish grade of planting areas before planting and after addition of soil additives shall be specified distances below top of adjacent pavement of any kind:

a. Sodded Areas: 2 inches below.

b. Shrub Areas: 4 inches below

B. Do not expose or damage existing shrub or tree roots.

C. Redistribute approved existing topsoil stored on site as a result of work of regrading. Remove organic material, rocks and clods greater than 1-1/2 inch in any dimension, and other objectionable materials. Provide additional approved imported topsoil required to bring surface to specified elevation relative to concrete site elements. Do not place topsoil whose moisture content makes it prone to compaction during placement process.

D. Slope grade away from building for 12 feet minimum from walls at slope of 1/2 inch in 12 inches minimum unless otherwise noted. High point of finish grade at building foundation shall be 6 inches minimum below finish floor level. Direct surface drainage in manner indicated on Drawings by molding surface to facilitate natural run-off of water. Fill low spots and pockets with topsoil and grade to drain properly.

E. After landscape areas have been prepared, take no heavy objects over them except lawn rollers. Immediately before planting lawn and with topsoil in semi-dry condition, roll areas that are to receive lawn in two directions at approximately right angles with water ballast roller weighing 100 to 300 lbs. depending on soil type. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

END OF SECTION

SECTION 32 9223
SODDING

PART 1 – GENERAL

1.01 RELATED WORK

A. Division 1 - Submittal Procedures.

B. Section 32 9120 - Topsoil Placement and Grading.

1.02 SUBMITTALS

A. Submit: Submit in accordance with Submittal Procedures.

1. Sod for each type specified.
2. Install approved samples in one square yard mock-ups and maintain in accordance with maintenance requirements during establishment period.
3. Bio-degradable geotextile fabric.
4. Obtain approval of samples by Owner’s Representative.

1.03 QUALITY ASSURANCE

A. Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

B. Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

C. Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.04 SCHEDULING

A. Schedule sod installation when frost has left ground and before June 15 or between August 15 and September 30.

B. Schedule sod laying to coincide with preparation of soil surface.

PART 2 PRODUCTS

2.01 MATERIALS

A. Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.

1. Number one Named Cultivars: Nursery Sod grown from certified seed.
2. Turf Grass Nursery Sod Quality:
   a. Not more than 2 broadleaf weeds or 10 other weeds per 400 square feet.
   b. Density of sod sufficient so that no soil is visible from height of 60 inches when mown to height of 2 inches.
   c. Mowing height limit: 1-1/4” to 2-1/2”.
   d. Soil portion of sod: 1/4" to 3/4' in thickness.

B. Commercial Grade Turf Grass Nursery : Sod that has not been grown as Turfgrass Nursery Sod crop.

1. Mow sod at height directed by Owner’s Representative within 36 hours prior to lifting, and remove clippings.

C. Sod establishment support:
   a. Geotextile fabric: biodegradable, 1 inch square mesh.
   b. Wooden pegs: 3/4" x 1/4” x 10”.
D. Water:
   a. Supplied by Owner’s Representative at designated source.
   b. Potable, free of impurities.
E. Fertilizer:
   a. USDA Fertilizer Regulations.
   b. Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.02 SOURCE QUALITY CONTROL

A. Obtain approval from Owner’s Representative of sod at source.
B. When proposed source of sod is approved, use no other source without written authorization.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that grades are correct and prepared in accordance with Section 32 9120 - Topsoil Placement and Grading. If discrepancies occur, notify Owner’s Representative.
B. Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
C. Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 1/4 inch, for Turfgrass Nursery Sod, and plus or minus 1/2 inch for commercial grade turfgrass nursery, surface to drain naturally.
D. Remove and dispose of weeds; debris; stones 2 inches in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Owner’s Representative.
E. Cultivate fine grade approved by Owner’s Representative to 1 inch depth immediately prior to sodding.

3.02 SOD PLACEMENT

A. Lay sod within 24 hours of being lifted.
B. Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
C. Roll sod as directed by Owner’s Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.03 SOD PLACEMENT ON SLOPES AND PEGGING

A. Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
B. Start laying sod at bottom of slopes.
C. Lay sod sections longitudinally, along contours of slopes as indicated.
D. Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 3 feet of catch basins and within 3 feet of drainage channels and ditches to following pattern:
   a. 4 inches below top edge at 8 inches on center for first sod sections along contours of slopes.
   b. Not less than 9 pegs per square yard.
   c. Not less than 12 pegs per square yard in drainage structures. Adjust pattern as directed by

Owner's Representative.

d. Drive pegs to 3/4 inches above soil surface of sod sections.

3.04 FERTILIZING PROGRAM

A. Fertilize during establishment and warranty periods to following program agreed to by Owner's Representative.

3.05 MAINTENANCE DURING ESTABLISHMENT PERIOD

A. Perform following operations from time of installation until acceptance.

B. Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 3 inches to 4 inches.

C. Cut grass to 2 inches when or prior to it reaching height of 3 inches. Remove clippings as directed by Owner's Representative.

D. Maintain sodded areas weed free.

E. Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.06 ACCEPTANCE

A. Turfgrass Nursery Sod areas will be accepted by Owner's Representative provided that:

1. Sodded areas are properly established.
2. Sod is free of bare and dead spots, and without weeds.
3. No surface soil is visible from height of 5 Feet when grass has been cut to height of 2 inches.
4. Sodded areas have been cut minimum 2 times, and within 24 hours prior to acceptance.
5. Fertilizing in accordance with fertilizer program has been carried out at least once.
6. Sodded Commercial Grade Turfgrass Nursery Sod areas will be accepted by Owner's Representative provided that:
   a. Sodded areas are properly established.
   b. Extent of surface soil visible when grass has been cut to height of 3 inches is acceptable.
   c. Sod is free of bare or dead spots and extent of weeds.
   d. Sodded areas have been cut minimum 2 times prior to acceptance.
   e. Fertilizing in accordance with fertilizer program has been carried out at least once.

B. Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

C. When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

3.07 MAINTENANCE DURING WARRANTY PERIOD

A. Perform following operations from time of acceptance until end of warranty period:

1. Water sodded Turfgrass Nursery Sod and Commercial Grade Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 4 inches.

B. Repair and resod dead or bare spots to satisfaction of Owner's Representative.

C. Cut grass and remove clippings as directed by Owner's Representative.

1. Turf Grass Nursery Sod:
   a. 2 inches during normal growing conditions.

2. Commercial Grade Turfgrass Nursery Sod:
   a. 2-1/2 - 3 inches during normal growing conditions.
3. Cut grass as directed by Owner's Representative but at intervals so that approximately one third of growth is removed in single cut.

D. Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

E. Eliminate weeds by mechanical means to extent acceptable to Owner's Representative.

3.08 CLEANING

A. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION