

FREDERICK COUNTY, MARYLAND

OFFICE OF PROCUREMENT & CONTRACTING

12 East Church Street, Winchester Hall
Frederick, Maryland 21701



INVITATION FOR BID (IFB) #26-625-CP

PROJECT MANUAL For WESTVIEW FIRE STATION 31 INTERIOR RENOVATION

Bid Due Date:

May 26, 2026, before 2:00 PM

**Buyer: Brian Stieg, CPPB
Phone: 240-931-8269**

**Email: bstieg@frederickcountymd.gov
www.FrederickCountyMD.gov**

FREDERICK COUNTY DIVISION OF PUBLIC WORKS

Westview Fire Station 31

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CONDITIONS OF THE CONTRACT

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
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PROJECT DIRECTORY

Project	Westview Fire Station 31
Owner	Frederick County, Maryland Winchester Hall 12 East Church Street Frederick, Maryland 21701
Procurement & Contracting Director	Frederick County Office Of Procurement & Contracting Winchester Hall 12 East Church Street Frederick, Maryland 21701 Attn: Justin Hedges, CPPB, PMP, Acting Office Director 301-600-1002 jhedges@frederickcountymd.gov
Procurement & Contracting Buyer	Frederick County Office of Procurement & Contracting Winchester Hall 12 East Church Street Frederick, Maryland 21701 Attn: Brian Stieg, CPPB, PMP 240-931-8269 bstieg@frederickcountymd.gov
Project Manager	Frederick County Division of Public Works Division of Public Works 355 Montevue Lane, Suite 200 Frederick, Maryland 21702 Attn: Ryan Hammond, Project Manager 301-600-6020 227-226-7831 rhammond@frederickcountymd.gov
Engineer/Consultant	Manns Woodward Studios, Inc 8098 Sandpiper Circle, Suite H Nottingham, Maryland 21236 Attn: Mike Matula 410-344-1460 mmatula@mwsarch.com

FREDERICK COUNTY DIVISION OF PUBLIC WORKS

Westview Fire Station 31

INVITATION FOR BIDS

NO. 26-625-CP

Frederick County, Maryland will receive **electronic** Sealed Bids from General Contractors for the renovation of **Westview Fire Station 31 until May 26, 2026, by 2:00 PM (EST)**, at which time, Bids will be opened and publicly read aloud over a conference call line using the call-in number and participant code listed below. Bids received after that time and date will not be accepted.

Please be advised that NO hand-delivered solicitation responses will be accepted at this time. Solicitation responses must be submitted electronically through OpenGov.

Bid Opening Conference Call: Dial the call-in number, enter the participant code followed by the pound (#) sign.

Dial: 866-818-0460

Participant Login: 7070570#

Description of Work:

The work is located at the following location: 5525 New Design Road Frederick MD 21703.

The Work of this Project is defined by the Contract Documents and includes but is not limited to the following:

Work shall generally include the interior renovation of an existing fire station with an approximate footprint of 10,750 SF, including all architectural, structural, plumbing, mechanical, electrical, fire protection, and related disciplines.

Construction Sequence: -

Anticipated Schedule:

- Anticipated Notice of Award: July 2026
- Anticipated Notice to Proceed: August 2026
- Anticipated Completion: August 2027

Frederick County will obtain the required construction permits for the project. It shall be the successful contractor's responsibility to provide all other applicable permits.

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Pre-Bid Conference

A non-mandatory pre-bid conference will be conducted on, **May 12, 2026, at 2:00 p.m. at the Westview Fire Station: 5525 New Design Road Frederick MD 21703**

Bid Documents

Bids must be made in accordance with the requirements in the bid documents.

There is no charge for the bid documents.

Bid documents may be obtained as follows:

- If you are registered to receive bid announcements on OpenGov, go to the Open Bids- Current Solicitation page at [Open Bids - Current Solicitations | Frederick County MD - Official Website](#) and download a copy of the bid.
- If you are not yet registered to receive bid announcements through OpenGov, go to [Vendor Registration | Frederick County MD - Official Website](#) and follow the instructions to register.
- When you have completed the bid announcement registration, go to the Current Solicitations Page identified above to download a copy of the bid.

NOTICE: CONTRACTORS, SUBCONTRACTORS AND SUPPLIERS THAT DO NOT REGISTER WILL NOT RECEIVE NOTIFICATION OF ADDENDA, THEREFORE, THE COUNTY ASSUMES NO RESPONSIBILITY FOR THE FAILURE OF NON-REGISTERED ENTITIES TO RECEIVE ADDENDA.

1. Presentation of Bids:

Presentation of bids shall be in strict accordance with the Instructions to Bidders included in the project Specifications (Section 00100). Bids shall be addressed to Frederick County and identified as Bid Number 26-625-CP. Please be advised that NO hand-delivered solicitation responses will be accepted at this time. **Bids shall be submitted electronically through OpenGov.**

Bids shall include:

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- Bid Security
- Bid Proposal
- Attachment A-1 – Unit Price Contingent Items Form
- Bidder Certification of Work Capacity
- Affidavit of Qualification to Bid
- Two Certifications of Compliance
- Affidavit

2. Bid Security and Guarantee:

The Contractor shall submit bid security in the form of Bid Bonds, Certified Checks, or Cashier's Checks in the amount of Five Percent (5%) of Bidder's maximum total project bid price, including Unit Price Contingent Items. Security shall be made payable to Frederick County, Maryland. Bid Bonds shall be issued by a surety company licensed to conduct business in the State of Maryland and shall be written on EJCDC C-430 Bid Bond (2002 Edition).

Bid Security and Guarantee shall meet all requirements of Instructions to Bidders Article 8 in EJCDC C-200, 2002 Edition. Such bid security shall be submitted with the understanding that it shall guarantee that the Bidder will not withdraw its bid for a period of One Hundred Twenty (120) days after the closing time for receipt of bids; that if its bid is accepted the Bidder will enter into a formal contract with the Owner and that the required Insurance and Performance and Payment Bonds will be promptly obtained and submitted to the Owner. In the event Bidder withdraws its bid within this period or fails to enter into a contract and/or give the required submittals within the time designated to submit same, the Bidder shall be liable to the Owner for the full amount of the bid security representing the damage to the Owner on account of the Bidder.

The bid security of unsuccessful Bidders may be returned in accordance with the requirements of Instructions to Bidders Article 8 (EJCDC C-200, 2002 Edition).

3. Performance Bond and Payment Bond:

The successful Bidder shall furnish performance and payment bonds covering the faithful performance of the Contract and payment of all obligations there under, each in the amount of One Hundred Percent (100%) of the total Contract Sum, including Unit Price Contingent Items. Each Bond shall be issued by a Surety Company licensed to conduct business in the State of Maryland and shall be delivered to the Frederick County Office of Procurement and Contracting within seven (7) days after Notice of Award of the Contract. The bonds shall be written on EJCDC C-610 – Performance Bond (2002 Edition) and EJCDC C-615 – Payment Bond (2002 Edition).

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4. Time of Completion and Liquidated Damages:

The Contractor shall commence the "Work" under this Contract per the construction start date established in the Notice-to-Proceed, prosecute said "Work" diligently and complete the Work within 340 (Three Hundred-Forty) calendar days.

In case of failure on the part of the Contractor to complete the Work within the time fixed in the Contract or any extensions thereof, the Contractor shall pay the Owners, as fixed and agreed upon liquidated damages, the sum of \$1,000 (One Thousand) per calendar day to Frederick County for each calendar day in excess of the Contract Time stated above or as otherwise modified and agreed to by the Owner and Contractor.

5. Site Visitation: A Site Visit will be held immediately following the pre-bid conference at the Westview Fire Station.

6. Award or Rejection of Bids:

A bidder may be required to submit evidence that they have appropriate experience, and financial resources available to undertake and perform the Contract properly and expeditiously, and any other information that may be required to indicate their ability to fulfill the Contract. **This may include, but not be limited to, submission of at least three similar projects performed within the last three years** (including the name of the Owner and the name and telephone number of an authorized representative of the Owner familiar with the project). It is the intent of the Owners to award the construction contract to the lowest responsive and responsible Bidder, complying with all the provisions of the Instructions to Bidders, provided the bid price is reasonable and it is to the interest of the Owner to accept it. Frederick County, Maryland reserves the right to cancel the project, at no penalty, up to the issuance of the "Notice to Proceed". Frederick County, Maryland or its authorized agent(s) reserve the right to reject any or all bids and to waive any informality or deficiency in bids received, whenever such rejection or waiver is in the best interest of the County. Frederick County, Maryland also reserves the right to reject the bid of a Bidder who has previously failed to perform properly or to complete, on time, contracts of a similar nature, or the bid of a Bidder, who after investigation, is not in a position to perform the Contract.

As a condition of award the successful Bidder will be required to submit bonds and insurance prior to the execution of the Contract by the Owner. Failure to meet this requirement shall constitute abandonment of the Bid by the Bidder and forfeiture of the bid security. The bid may then be awarded to the next lowest bidder.

7. Bid Protest:

The County's Bid Protest Procedure may be accessed at:

<http://www.frederickcountymd.gov/index.asp?nid=1116>

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Frederick County Government does not discriminate on the basis of race, color, national origin, sex, religion, age and disability in employment or the provision of services.

Individuals requiring special accommodations are requested to contact the Office of Procurement and Contracting at (301) 600-1067 (Voice), or (301) 694-1672 (Voice/TDD) to make arrangements no later than Ten (10) working days prior to any meeting.

8. Solicitation Administration:

All communications relative to the bid for this Work shall be directed to Brian Stieg, (301-600-1002), Procurement Analyst IV prior to the opening of Bids and **no later than May 15, 2026**. All questions relating to interpretation of the Contract Documents or requests for clarification must be submitted in writing. E-mail: bstieg@frederickcountymd.gov.

BY AUTHORITY OF:

Frederick County, Maryland

Justin Hedges, CPPB, PMP, Acting Office Director, Office of Procurement & Contracting

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SECTION 00100 - INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DESCRIPTION

- A. The "Instructions to Bidders," EJCDC Document C-200, Version 2002, herein referred to as the INSTRUCTIONS TO BIDDERS, as modified, shall govern the bidding. The modified EJCDC C-200 is attached.

END OF SECTION 00100

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



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The Associated General Contractors of America



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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

- A. *Issuing Office*--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered. The Frederick County Office of Procurement and Contracting (P&C) is fulfilling the role of the *Issuing Office*. Their mailing address is 12 East Church Street, Frederick, Maryland, 21701.
- B. *Engineer* – The design firm who was contracted by Frederick County to produce the project specific construction documents.
- C. *Owner* – The individual or entity with whom the Contractor has entered into the Agreement and for whom the Work is to be performed.
- D. *EJCDC* - Engineers Joint Contract Documents Committee

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Frederick County initiated the use of a new procurement system on July 1, 2017. Bid announcements continue to be performed using the legacy system and documents can be obtained as described below.

There is no charge for the bid documents. Downloading the Contract Documents will permit the bidder to take Contract Documents to the “print shop” of their choice for printing.

Bid documents may be obtained as follows:

- If you are registered to receive bid announcements on the Frederick County Procurement and Contracting website, go to the Current Solicitations Page at <https://www.frederickcountymd.gov/1116/Current-Solicitations> and download a copy of the bid.
- If you are not yet registered to receive bid announcements on the Frederick County Procurement and Contracting website, go to <https://www4.frederickcountymd.gov/VendorSignIn/> and follow the instructions to register.
- When you have completed the bid announcement registration, go to the Current Solicitations Page identified above to download a copy of the bid.
- Supplier registration in Frederick County’s new procurement system is strongly encouraged and is now required in order to be awarded a bid. At a yet to be determined future date bid announcements will only be made by the new system. In order to register in the new procurement system please go to the following web page (note: it is necessary to submit a W-9 with your registration):
www.frederickcountymd.gov/procurement

NOTICE: CONTRACTORS AND SUBCONTRACTORS THAT DO NOT REGISTER FOR BID ANNOUNCEMENTS WILL NOT RECEIVE NOTIFICATION OF ADDENDA; THEREFORE THE COUNTY ASSUMES NO RESPONSIBILITY FOR THE FAILURE OF NON-REGISTERED ENTITIES TO RECEIVE ADDENDUMS.

No bids will be considered unless accompanied by a certified check, cashier’s check, or a treasurer’s check drawn on a bank or a bid bond payable to Frederick County, Maryland in the amount of five (5) percent of the total bid price.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder may be required to submit written evidence such as financial data, previous experience, present commitments, staff qualifications and such other data as may be called for below. Requested information shall be submitted within 3 days of receipt of request from the County.

- A. Contractor's Qualification Statement
- B. List of Subcontractors
- C. Contractor's most recent annual and previously filed audited financial statements, including your latest balance sheet, income statement, cash flows and notes to the financial statements showing the following items:
 - Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);
 - Net Fixed Assets;
 - Other Assets;
 - Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);
 - Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 *Subsurface and Physical Conditions*

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by Owner to all Bidders as part of the Bidding Documents. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been identified and established in Paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 *Hazardous Environmental Condition*

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to all Bidders as part of the Bidding Documents. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established in Paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 4.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions;

E. obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A pre-Bid conference will be held at the time and location identified in the Notice Inviting Bids. Representatives of Owner and Engineer will be present to discuss the Project. This Pre-Bid Conference is not mandatory. Interested Sub Contractors are encouraged to attend and participate in the conference. P&C will transmit to all prospective Bidders of record such Addenda as the Owner considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to P&C in writing or by electronic mail. Interpretations or clarifications considered necessary by the Owner in response to such questions will be issued by Addenda mailed, e-mailed, or delivered to all parties recorded by the Owner as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. The Owner intends to issue the final addenda at least seven (7) days prior to the advertised bid opening. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5% percent of Bidder's maximum Bid price and in the form of a certified check or a Bid bond (*see EJCDC document No. C-430* on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or **120** days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, Milestones are to be achieved, and the “Work” is to be completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND “OR-EQUAL” ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or those substitute or “or-equal” materials and equipment approved by the Owner and Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or “or-equal” item. No item of material or equipment will be considered by the Owner and Engineer as a substitute or “or-equal” unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. The Owner’s and Engineer decision of approval or disapproval of a proposed item will be final. If the Owner and Engineer approve any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions or other contract documents require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

13.02 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternative, adjustment unit price item, and unit price item listed therein, or the words “No Bid,” “No Change,” or “Not Applicable” entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.

13.06 A Bid by an individual shall show the Bidder’s name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 The address and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder’s state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 *If identified as Lump Sum on the Bid Form*

A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate. In the comparison of Bids, alternates will be applied in the same order as listed in the Bid form.

14.02 *If identified as Unit Price on the Bid Form*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Itemized Bid Form.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.03 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

ARTICLE 15 - SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the following data:

- A. Required Bid Security (if providing a bid bond use EJCDC C-430 (2002 Edition) bid bond form);
- B. Attachment A-1, Unit Price Contingent Items Bid Form;
- C. Bidder Certification of Work Capacity;
- D. Affidavit of Qualification to Bid;
- E. Two Certifications of Compliance;
- F. Affidavit;

15.02 A Bid shall be submitted no later than the date and time prescribed through OpenGov.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Bid Form.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 7 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner.

ARTICLE 22 - SALES AND USE TAXES

22.01 Owner is not exempt from State sales and use taxes for materials and equipment to be incorporated in the Work.

ARTICLE 23 - RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

ARTICLE 24 - CONTRACTS TO BE ASSIGNED (Not Applicable)

ARTICLE 25 – PARTNERING (Not Applicable)

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
Westview Fire Station 31

SECTION 00200 – BID FORM FOR CONSTRUCTION CONTRACTS

ARTICLE 1 - DESCRIPTION

- A. The “BID FORM FOR CONSTRUCTION CONTRACTS,” EJCDC Document C-410, Version 2002, herein referred to as the BID FORM, as modified, shall govern the bidding. The modified EJCDC C-410 is attached.

END OF SECTION 00200

Bidder Name: _____

BID FORM FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
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BID FORM

IFB 26-625-CP

Bidder Name: _____

FREDERICK COUNTY PROJECT No. 26-625-CP

Westview Fire Station 31

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Bidder Name: _____

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Frederick County, MD
c/o Justin Hedges, CPPO, Acting Office Director, Office of Procurement & Contracting
Winchester Hall
12 East Church Street
Frederick, MD 21701

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 120 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02, and (2) reports and drawings of Hazardous Environmental Conditions that have been identified in SC-4.06.

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and

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Bidder Name: _____

procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

- F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

- A. this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

<i>Lump Sum Bid Price for the renovation of the Westview Fire Station per the Drawings and Specifications</i>	<i>(in words)</i>	<i>(numerals)</i>
<i>Total Contingent Items Price (sum of Unit Price Extensions for Contingent Items 15, 17, 19-24, 27-33 and 36-38 per Attachment A-1)</i>	<i>(in words)</i>	<i>(numerals)</i>

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Bidder Name: _____

<i>Total Contract Price (sum of Total Base Bid Price and Total Contingent Items Price)</i>	<i>(in words)</i>	<i>(numerals)</i>

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated Base Bid and Unit Contingent Item quantities are not guaranteed. The quantities for the Base Bid and Unit Contingent Items shown in this Proposal Form are established for the purpose of comparison of Bids. The quantities for these base bid and Unit Contingent Items may be increased or decreased without any adjustment to the unit price bid by Bidder. No claim for additional costs will be considered should any of the Base Bid or Unit Contingent Item quantities be increased or decreased.

The Unit Contingent Items identified in this Proposal Form are provided in the Contract for use when and as directed by the Program Manager/Construction Manager for the incorporation of additional work not specified in the contract documents. All items of Work may not necessarily occur on the Contract Documents; however, during the course of the Work, the Program Manager/Construction Manager may direct the incorporation of any or all of the Contingent Items

Payment for Base Bid and Unit Contingent Items will be based on quantities as actually measured. Each Base Bid and Unit Contingent Item unit price shall include all labor, materials, and incidental costs necessary to complete the Work required by the item. The unit prices bid shall include all direct and indirect costs, overhead and profit, taxes and insurance.

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the “Work” as defined in Paragraph 1.01.A.52 of the General Conditions, will be complete no later three hundred forty (340) calendar days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and that the “Work” will be completed and ready for final payment in accordance with Specification Section 01770 Closeout Procedures.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The following documents are attached to and made a condition of this Bid:
- A. Required Bid Security (if providing a bid bond use EJCDC C-430 (2002 Edition) bid bond form);
 - B. Attachment A-1, Unit Price Contingent Items Bid Form;
 - C. Bidder Certification of Work Capacity;
 - D. Affidavit of Qualification to Bid;
 - E. Two Certifications of Compliance;
 - F. Affidavit;

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Bidder Name: _____

ARTICLE 8 – DEFINED TERMS

- 8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

- 9.01 This Bid submitted by:

NAME OF FIRM: _____

ADDRESS: _____

PHONE: _____ FAX: _____

CONTACT NAME: _____ EMAIL: _____

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Bidder Name: _____

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Date of Qualification to do business in Maryland is: ____ \ ____ \ ____.

FREDERICK COUNTY DIVISION OF PUBLIC WORKS

WESVIEW FIRE STATION 31

UNIT PRICE CONTINGENT ITEMS

The Unit Price Contingent Items identified in this Proposal Form are provided in the Contract for use when and as directed by the Program Manager for the incorporation of additional work not specified in the Contract Documents; however, during the course of the work, the Project Manager may direct the incorporation of any or all of the items. The quantities for the Unit Price Contingent Items shown in this Proposal Form are established for the purpose of obtaining a proposal price. The quantities for these Unit Price Contingent Items may be increased or decreased without any adjustment to the unit price proposal or may be eliminated entirely from the Contract by the Project Manager without negotiation. No claim for additional costs will be considered should any of the Unit Price Contingent Items be increased, decreased, or eliminated. Contingent item unit prices remain binding for the duration of the contract (and renewals, if any).

Payment for Unit Price Contingent Items will be made on the basis of the quantities as actually measured. Each unit price shall include all labor, materials, mobilization and incidental costs necessary to complete the work required by the item. The unit prices shall include all direct and indirect costs, overhead and profit, taxes, and insurance. **These Unit Price Contingent Items do not form a portion of the Contractor's Base Proposal.** Write in the unit prices in clear numerals and make extensions.

ITEM NO.	DESCRIPTION	UNIT OF MEASUREMENT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL
UCI-15	4" PVC Conduit	LF	100		
UCI-17	Pipe Bollards	EA	1		
UCI-19	SHA Type A Curb/Gutter	LF	50		
UCI-20	2'x2' Lay-in Ceiling Tile with Grid	SF	100		
UCI-21	Resinous Flooring	SF	100		

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UCI-22	Carpet Tile	SF	100		
UCI-23	Base Moulding	LF	50		
UCI-24	Vinyl Wall Cover	SF	200		
UCI-27	Duplex 120V Electrical Outlet	EA	5		
UCI-28	Duplex 120V Electrical Outlet, Dedicated	EA	5		
UCI-29	20AMP, 120V Light Switch	EA	5		
UCI-30	20AMP, 120V Dimmer Switch 20	EA	5		
UCI-31	2'x4' Fluorescent Light Fixture	EA	5		
UCI-32	Emergency Exit Light	EA	5		
UCI-33	Emergency Exit Sign	EA	5		
UCI-36	Voice/Data Outlet with Conduit & Box	EA	5		
UCI-37	Duct Access Door 12"x12"	EA	1		
UCI-38	Conduit 3/4" for Misc. Wiring, Installed	LF	500		

TOTAL UNIT PRICE CONTINGENT ITEMS (SUM OF TOTAL AMOUNTS FOR UCIs #15, 17, 19-24, 27-33 and 36-38)

\$ _____

**FREDERICK COUNTY DIVISION OF PUBLIC WORKS
WESTVIEW FIRE STATION 31**

DESCRIPTION OF UNIT PRICE CONTINGENT ITEMS

UCI -15 – 4” PVC Conduit Basic Materials and Methods) for additional conduit beyond what is indicated in the Contract Documents to be used for underground routing of electrical, security, or communications cabling. Unit price shall include trenching, excavation and backfill, furnishing and installing bedding material and pipe, and all labor, equipment, materials, and incidentals necessary to complete the work. Payment will be made for the actual quantities measured at the unit price per linear foot as listed in the Contingent Items Proposal Form.

UCI-17 - Pipe Bollards consists of furnishing and installing the pipe Bollards as shown on the plans and as specified. These items shall be paid at the unit contingent price per each pipe Bollard furnished and installed in locations not already shown on the contract documents. The unit price shall include the cost of shipping, excavation and backfill, concrete for footings, and all labor, equipment, materials, and incidentals necessary to complete the work.

UCI-19 - SHA Standard Type “A” Curb and Gutter consists of constructing curbing, not shown on the construction documents, as directed by the owner. Refer to Specification Section 02741 – Hot-Mix Asphalt Paving, for all requirements. This item shall be paid at the unit contingent price per linear foot of curbing required, furnished and installed. The unit price shall include the cost of forms, excavation, concrete, backfill, graded aggregate base, joint sealer, all labor, materials, equipment, and incidentals necessary to complete the work.

UCI-20 – 2’x2’ Lay-In Ceiling Tile with Grid consists of installing acoustical ceiling tile, not shown on the construction documents, as directed by the owner. This item shall be paid at the unit contingent price per square foot of additional ceiling tile furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-21 – Resinous Flooring consists of installing resinous flooring as directed by the owner. Refer to Specification Section 09705 – Resinous Flooring, for all requirements. This item shall be paid at the unit contingent price per square foot of additional resinous flooring furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-22 – Carpet Tile consists of installing carpet, not shown on the construction documents, and as directed by the owner. This item shall be paid at the unit contingent price per square foot of additional carpet furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-23 – Base Molding consists of installing additional molding, not shown on the construction documents, and as directed by the owner. This item shall be paid at the unit contingent price per lineal foot of additional molding furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-24 – Vinyl Wall Covering (Acrovyn) consists of installing additional wall coverings, not shown on the construction documents, and as directed by the owner. This item shall be paid at the unit contingent price per square foot of additional wall covering furnished and installed. The unit

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price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-27 – Duplex 120v Electrical Outlet consists of installing an additional duplex outlet not shown on the construction documents but connected to an electrical circuit already shown. The architect will identify the existing circuit that the outlet will be connected. This item shall be paid at the unit contingent price per outlet furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-28 – Duplex 120v Electrical Outlet on a Dedicated Circuit consists of installing an additional duplex outlet and circuit to a service panel identified by the architect but within 200 feet of the outlet. This item shall be paid at the unit contingent price per outlet on a dedicated circuit furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-29 – 20amp, 120v Light Switch consists of installing an additional light switch not shown on the construction documents but connected to an electrical circuit already shown. The architect will identify the existing circuit that the switch will be connected. This item shall be paid at the unit contingent price per switch furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-30 – 20amp, 120v Dimmer Switch consists of installing an additional dimmer light switch not shown on the construction documents but connected to an electrical circuit already shown. The architect will identify the existing circuit that the outlet will be connected. This item shall be paid at the unit contingent price per switch furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-31 – 2'x4' Fluorescent Light Fixture consists of installing an additional light fixture not shown on the construction documents but connected to an electrical circuit already shown. The architect will identify the existing circuit that the outlet will be connected. This item shall be paid at the unit contingent price per fixture furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-32 – Emergency Exit Light consists of installing an additional light fixture not shown on the construction documents. The light will be similar to the light specified (either battery or electrical circuit) in the contract documents. This item shall be paid at the unit contingent price per light furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-33 – Emergency Exit Sign consists of installing an additional sign fixture not shown on the construction documents. The sign will be identical to the sign specified (not battery powered) in the contract documents. This item shall be paid at the unit contingent price per sign furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the additional work.

UCI-36 – Voice and Data Outlet with Conduit and Box consists of installing additional conduit and box required for the Owner to pull the necessary cable and install the outlet. The conduit length will not exceed 100 feet and will connect to the data closet identified by the Owner. This item shall be paid at the unit contingent price per additional outlet identified to be furnished and

FREDERICK COUNTY DIVISION OF PUBLIC WORKS

WESTVIEW FIRE STATION 31

installed by the Owner. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the conduit and box installation.

UCI-37 – Duct Access Door, 12"x12" consists of installing an additional duct access door not shown on the construction document. This item shall be paid at the unit contingent price per door furnished and installed. The unit price shall include the cost of all labor, materials, equipment, and incidentals necessary to complete the work.

UCI -38 – Conduit ¾" Misc. Wiring, Installed Basic Materials and Methods for additional conduit beyond what is indicated in the Contract Documents to be used for routing of electrical, security, or communications cabling within the building envelope. Unit price shall include all labor, equipment, materials, and incidentals necessary to complete the work. Payment will be made for the actual quantities measured at the unit price per linear foot as listed in the Contingent Items Proposal Form.

END OF UNIT CONTINGENT ITEMS

BID FORM ATTACHMENTS

BIDDER CERTIFICATION OF WORK CAPACITY
AFFIDAVIT OF QUALIFICATION TO BID
TWO CERTIFICATIONS OF COMPLIANCE
AFFIDAVIT

BIDDER CERTIFICATION OF WORK CAPACITY

This certifies that the undersigned guarantees all of the work performed under this Contract to be done in accordance with the Specifications and Special Provisions in a good workmanlike manner and to renew or repair any work which may be rejected due to defective workmanship or materials, prior to final completion and acceptance of the work. Also, we have the equipment, labor supervision, and financial capacity to perform this Contract either with our organization or with subcontractors.

BIDDER: _____

BY: _____

SIGNATURE

TITLE: _____

Sworn to before me this _____ day of _____, 20____

My commission expires _____.

NOTARY PUBLIC

AFFIDAVIT OF QUALIFICATION TO BID

I hereby affirm that:

1. I am the _____ and duly authorized representative
TITLE
of the firm _____
NAME OF CORPORATION
of whose address is _____
and that I possess the legal authority to make this affidavit on behalf of myself and the
firm for which I am acting.
2. Except as described in Paragraph 3 below, neither I nor the above firm, nor to the best
of my knowledge, any of its officers, directors, or partners, or any of its employees
directly involved in obtaining Contracts with the State, any unit of the State, or any
local governmental entity in the State (including a county, bi-county, or multi-county
governmental entity) have been convicted of, or have pleaded nolo contendere to, a
charge or have during the course of an official investigation or other proceeding
admitted, in writing or under oath, acts or omissions which constitute bribery,
attempted bribery, or conspiracy to bribe under the provisions of Article 27 of the
Annotated Code of Maryland or under the laws of any State or the Federal Government.
(Conduct prior to July 1, 1977 is not required to be reported).
3. _____
(State "None" or, as appropriate, list any conviction, plea, or admission described in
Paragraph 2 above, with the date; court, official or administrative body, the individuals
involved and their position with the firm; and the sentence of disposition, if any.)

I acknowledge that this affidavit is to be furnished to the Owner and, where appropriate, to the Board
of Public Works and the Attorney General under Maryland State Finance and Procurement Code
Annotated, Sections 16-2001 through 16-208. I acknowledge that, if the representations set forth in
this affidavit are not true and correct, the Owner may terminate any Contract awarded and take any
other appropriate action. I further acknowledge that I am executing this affidavit in compliance with
Maryland State Finance and Procurement Code Annotated, Sections 16-201 through 16-208, which
provides that certain persons who have been convicted or have admitted to bribery, attempted bribery,
or conspiracy to bribe, may be disqualified, either by operation of law or after a hearing, from entering
into Contracts with the State or any of its agencies or subdivisions.

I do solemnly declare and affirm under the penalties of perjury and upon personal knowledge that the
contents of this affidavit are true and correct.

BIDDER: _____

By: _____

SIGNATURE

Title: _____

Sworn to before me this _____ day of _____, 20____

My commission expires _____.

NOTARY PUBLIC

CERTIFICATIONS OF COMPLIANCE

1. **Certification of Compliance** with Frederick County Purchasing Regulation 1-2-36, Hiring of Illegal Aliens Prohibited for Performance of County Work:

I, _____, the owner/signatory of _____
 Signatory Name Name of Contractor

hereby certify or attest that:

- A. In compliance with Frederick County Purchasing Regulation 1-2-36, and as a contractual requirement of doing business with Frederick County, Maryland, my firm and all of my firm's subcontractors shall only employ individuals legally authorized to work within the United States of America in the performance of work under this contract.;
- B. Compliance is a material contractual obligation and that breach of this obligation may result in contract termination in addition to, and not in lieu of, any and all other remedies available to Frederick County, Maryland and any and all other damages for which my firm might be liable; and
- C. Nothing within Frederick County Purchasing Regulations requires Frederick County, Maryland to elect to terminate a contract for default to the exclusion of any other remedy.

By my signature below, I swear or affirm under penalties of perjury that the contents of this Certification of Compliance are true to the best of my knowledge, information and belief.

SIGNATURE OF SIGNATORY

DATE _____

2. **Certification of Compliance** with regards to Debarment of Suspension for applicable contracts under the U.S. Federal Awards Program, the following certification is required:

I, _____, the owner/signatory of _____
 Signatory Name Name of Contractor

hereby certify or attest that:

- A. In compliance with the U.S. Federal Awards Program, I certify that neither my firm nor any of my firm's subcontractors are suspended, debarred, proposed for debarment, or declared ineligible for the award of contracts from the United States federal government procurement or non-procurement programs, or are listed in the *List of Parties Excluded from Federal Procurement and Non-procurement Programs* issued by the General Services Administration.
- B. I certify that my firm will provide immediate written notice to the Director of Procurement & Contracting if, at any time prior to award, I find that this certification was erroneous when submitted or has become false by reason of changed circumstances.
- C. I understand that if the County later determines that this certification is false, in addition to other remedies available, the Director of Procurement & Contracting may terminate the Agreement resulting from this solicitation for default.

By my signature below, I swear or affirm under penalties of perjury that the contents of this Certification of Compliance are true to the best of my knowledge, information and belief.

SIGNATURE OF SIGNATORY

DATE _____

PRINT NAME OF SIGNATORY: _____

PRINT TITLE OF SIGNATORY:

AFFIDAVIT

(Must be completed and signed BY AN AUTHORIZED SIGNATORY, and submitted with the proposal.)

Contractor: _____

Address: _____

Telephone: _____ Proposal No.: _____

I, _____, the undersigned, _____ of the above name Contractor
Print Signer's Name Print Office Held

do declare and affirm this _____ day of _____, _____ that I hold the aforementioned office in the above named Contractor
Month Year

and I affirm the following:

AFFIDAVIT I: The Contractor, Agent and/or employees, have not in any way colluded with anyone for and on behalf of the Contractor or themselves, to obtain information that would give the Contractor an unfair advantage over others, nor have they colluded with anyone for and on behalf of the Contractor, or themselves, to gain any favoritism in the award of the contract herein.

AFFIDAVIT II: No officer or employee of Frederick County, whether elected or appointed, has in any manner whatsoever, any interest in or has received prior hereto or will receive subsequent hereto any benefit, monetary or material, or consideration from the profits or emoluments of this contract, job, work or service for the County, and that no officer or employee has accepted or received or will receive in the future a service or thing of value, directly or indirectly, upon more favorable terms than those granted to the public generally, nor has any such officer or employee of the County received or will receive, directly or indirectly, any part of any fee, commission or other compensation paid or payable to the County in connection with this contract, job, work, or service for the County, excepting, however, the receipt of dividends on corporation stock.

AFFIDAVIT III: Neither I, nor the Contractor, nor any officer, director, or partners, or any of its employees who are directly involved in obtaining contracts with Frederick County have been convicted of bribery, attempted bribery, or conspiracy to bribe under the laws of any state, or of the federal government for acts of omissions committed after July 1, 1977.

AFFIDAVIT IV: Neither I, nor the Contractor, nor any of our agents, partners, or employees who are directly involved in obtaining contracts with Frederick County have been convicted within the past 12 months of discrimination against any employee or applicant for employment, nor have we engaged in unlawful employment practices as set forth in Section 16 of Article 49B of the Annotated Code of Maryland or, of Sections 712 and 704 of Title VII of the Civil Rights Act of 1964.

AFFIDAVIT V: Neither I, nor the Contractor, nor any of our officers, directors, trustees or partners who are directly involved in obtaining contracts with Frederick County is a member of the County Council or the County Executive for Frederick County, Maryland, nor are we qualified relatives (spouse, parent, child) of said elected officials, nor are we a business entity in which a qualified relative of said elected officials has a direct financial interest.

AFFIDAVIT VI: The Contractor, Agent and/or employees working on its behalf, declare that they, in accordance with the Maryland Campaign Finance Reform Act of 2013, have not provided any campaign financing greater than \$200,000, OR having done so, they have filed the appropriate campaign finance-related disclosures with the State Board of Elections and that a copy of the certification is attached to their submission in response to this solicitation. Should the Contractor fail to provide the necessary documentation, the County will notify the State. The necessary documentation may be located: http://www.elections.state.md.us/campaign_finance/disclosure_of_contributions.html

I do solemnly declare and affirm under the penalties of perjury that the contents of the foregoing affidavits are true and correct to the best of my knowledge, information and belief.

DATE: _____

SIGNATURE OF SIGNATORY

EMAIL: _____

PRINTED NAME OF SIGNATORY

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
Westview Fire Station 31

SECTION 00300 – STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION
CONTRACT, FUNDING AGENCY EDITION

ARTICLE 1 - DESCRIPTION

- A. The “STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT, FUNDING AGENCY EDITION” EJCDC Document C-710, Version 2002, herein referred to as the “General Conditions” shall govern the bidding. The unmodified EJCDC C-710 is attached.

END OF SECTION 00300

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT FUNDING AGENCY EDITION

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



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AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

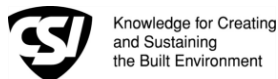
This document has been approved and endorsed by

The Associated General Contractors of America



and the

Construction Specification Institute



These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Funding Agency Edition No. C-521 (2002 Edition). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001, 2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800, 2002 Edition).

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GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agency* – The Federal or state agency named as such in the Agreement.
 3. *Agreement* – The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 4. *Application for Payment* – The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 5. *Asbestos* – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 6. *Bid* – The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 7. *Bidder* – The individual or entity who submits a Bid directly to Owner.
 8. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 9. *Bidding Requirements* – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.
 10. *Change Order* – A document recommended by Engineer which is signed by Contractor and Owner and Agency and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 11. *Claim* – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 12. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
 13. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

14. *Contract Price* – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
15. *Contract Times* – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
16. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.
17. *Cost of the Work* – See Paragraph 11.01.A for definition.
18. *Drawings* – That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
19. *Effective Date of the Agreement* – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
20. *Engineer* – The individual or entity named as such in the Agreement.
21. *Field Order* – A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
22. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
23. *Hazardous Environmental Condition* – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.
24. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
25. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
27. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
28. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
29. *Notice to Proceed* – A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
30. *Owner* – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
31. *PCBs* – Polychlorinated biphenyls.

32. *Petroleum* – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
33. *Progress Schedule* – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
34. *Project* – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
35. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
36. *Radioactive Material* – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
37. *Related Entity* – An officer, director, partner, employee, agent, consultant, or subcontractor.
38. *Resident Project Representative* – The authorized representative of Engineer who may be assigned to the Site or any part thereof.
39. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
40. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
41. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
42. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
43. *Site* – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
44. *Specifications* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
45. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
46. *Substantial Completion* – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
47. *Successful Bidder* – The Bidder submitting a responsive Bid to whom Owner makes an award.

48. *Supplementary Conditions* – That part of the Contract Documents which amends or supplements these General Conditions.
49. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.
50. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
51. *Unit Price Work* – Work to be paid for on the basis of unit prices.
52. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
53. *Work Change Directive* – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and Agency upon recommendation of the Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

- A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.
- B. *Intent of Certain Terms or Adjectives*
 1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.
- C. *Day*
 1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective*
 1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents, or

- b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or
 - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).
- E. *Furnish, Install, Perform, Provide*
 - 1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 - 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 - 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 - 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
1. a preliminary Progress Schedule;
 2. a preliminary Schedule of Submittals; and
 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, Agency, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 - 1. A Field Order;
 - 2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3) or
 - 3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or
 - 2. reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.
- B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for

giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and
2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

- A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data,
 - b. locating all Underground Facilities shown or indicated in the Contract Documents,
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.
- B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:
 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent’s authority to act.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

5.04 *Contractor’s Liability Insurance*

- A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor’s performance of the Work and Contractor’s other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers’ compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor’s employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
3. include completed operations insurance;
4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.
 - a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (Contractor shall be responsible for any deductible or self-insured retention.). This insurance shall:
 1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition

occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.
- B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 Waiver of Rights

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Contractor as trustee or otherwise payable under any policy so issued.

- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Contractor and made payable to Contractor as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Contractor shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof.
- B. Contractor as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Contractor's exercise of this power. If such objection be made, Contractor as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Contractor as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor’s representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

- a. in the exercise of reasonable judgment Engineer determines that:

- 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
- 3) it has a proven record of performance and availability of responsive service; and

- b. Contractor certifies that, if approved and incorporated into the Work:

- 1) there will be no increase in cost to the Owner or increase in Contract Times, and
- 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The procedure requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:

- a) will perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;
 - b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services;
 - 4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.
- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity, nor
 - 2. shall anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

- 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume

full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work, Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

- C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:
 - a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and
 - d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 - 1. observations by Engineer;
 - 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. use or occupancy of the Work or any part thereof by Owner;
 - 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 - 6. any inspection, test, or approval by others; or
 - 7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation,

or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed 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 Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
 - 1. written notice thereof will be given to Contractor prior to starting any such other work; and
 - 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and

shall properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
 - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 - 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 *Insurance*

- A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, subject to written approval by Agency at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
 - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any bond to be given to a surety, the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract

within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part,
 2. approve the Claim, or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to Engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressages, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the

Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A and 11.01.B.
- C. **Contractor's Fee:** When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. **Cash Allowances**
1. Contractor agrees that:
 - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*
1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 - 1. the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:
 - 1. a mutually acceptable fixed fee; or
 - 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

- a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
- b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
- c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.B.
 - 1. delays caused by or within the control of Contractor; or
- D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and
 - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations on the Site of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent

tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and

- c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. the Contractor's performance or furnishing of the Work is inconsistent with funding Agency requirements;
 - d. there are other items entitling Owner to a set-off against the amount recommended; or
 - e. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.
3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Agency, Contractor, and Engineer shall make a prefinal inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner, Agency, and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment*

- 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
- 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and

- d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. Engineer's Review of Application and Acceptance

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims. The remaining balance of any sum included in the final Application for Payment but held by OWNER for Work not fully completed and accepted will become due when the Work is fully completed and accepted.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 - 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 - 3. Contractor's disregard of the authority of Engineer; or
 - 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
 - 1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),
 - 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and
 - 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Owner and Contractor may mutually request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

- C. If the claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or
 - 2. agrees with the other party to submit the Claim to another dispute resolution process, or
 - 3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Agency Not a Party*

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

18.02 *Contract Approval*

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit GC-A) before Owner submits the executed Contract Documents to Agency for approval.
- B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

- A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer.
- B. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
- B. In the event this Contract is terminated as provided in paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

- A. For all negotiated contracts and negotiated modifications (except those of \$10,000 or less), Owner, Agency, the Comptroller General, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.

18.06 *Small, Minority and Women's Businesses*

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps shall consist of: (1) including qualified small, minority and women's businesses on solicitation lists; (2) assuring that small, minority and women's businesses are solicited whenever they

are potential sources; (3) dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses; (4) establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women's businesses; (5) using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; (6) requiring each party to a subcontract to take the affirmative steps of this section; and (7) Contractor is encouraged to procure goods and services from labor surplus area firms.

18.07 *Anti-Kickback*

- A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

18.08 *Clean Air and Pollution Control Acts*

- A. If this Contract exceeds \$100,000, Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401 *et seq.*) and the Federal Water Pollution Control Act as amended (33 USC 1251 *et seq.*). Contractor will report violations to the Agency and the Regional Office of the EPA.

18.09 *State Energy Policy*

- A. Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.

18.10 *Equal Opportunity Requirements*

- A. If this Contract exceeds \$10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
- B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.
- C. Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

18.11 *Restrictions on Lobbying*

- A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed \$100,000 at any tier under a Federal loan that exceeds \$150,000 or a Federal grant that exceeds \$100,000.

If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 USC 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

- A. When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:
1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.
 3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).
 4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

EXHIBIT GC-A

Certificate of Owner's Attorney

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows:

I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Date: _____

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SECTION 00320

SUPPLEMENTARY CONDITIONS TO THE GENERAL CONDITIONS OF THE CONTRACT FOR
CONSTRUCTION, FUNDING AGENCY EDITION
EJCDC C-710 (2002 EDITION)

General:

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, Funding Agency Edition (No. C-710, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

When General Condition Paragraphs or Subparagraphs are deleted in their entirety and replaced by referenced Specification Sections, any remaining General Condition cross-references such as "pursuant to", "as provided in", "established in", etc. also direct the Contract Documents to the referenced Specification Section.

Modifications to Article 1: - DEFINITIONS AND TERMINOLOGY

Paragraph 1.01- Defined Terms

Modify to read,

A.2 *Agency* - The County agency named as such in the agreement.

A.4 *Application for Payment* - The form acceptable to the Owner and provided by the Owner which is to be used by the Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

A.10 *Change Order* - A document which is signed by the Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or Contract Times. Change Orders are issued after the Effective Date of the Agreement and on a form acceptable to the Owner and provided by the Owner.

A.20 *Engineer* - The individual or entity named as such in the agreement. The defined term does not imply that the individual or entity is a registered engineer, but rather the design consultant contracted by the Owner to prepare the Contract Documents. The use of the word "Architect" is synonymous with "Engineer".

A.30 *Owner*- Change the text to read, "Frederick County, Maryland or any of their authorized agents or representatives."

A.46 *Substantial Completion* - Remove the words, "in the opinion of the Engineer" and replace with, "in the opinion of the Owner".

Add the Terms,

A.54 *DECM - Department of Engineering & Construction Management*. Acts as the Owner's representative for construction activities related to the Project and the Work and coordinates the Engineer's activities with other Owner agencies.

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A.55 *Construction Change Directive (CCD)* - A written statement to the Contractor issued on or after the Effective Date of the Agreement and signed by the Owner and Engineer that orders an addition, deletion, or revision in the Work or responds to differing or unforeseen subsurface or physical conditions. A Construction Change Directive will not change the Contract Price or Contract Times, unless signed by the Contractor, but will be used as evidence that the parties to the Work expect that the change ordered or documented by the Construction Change Directive will be incorporated in a subsequently issued Change Order following the negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times. CCDs will be issued on a form acceptable to the Owner and provided by the Owner. The use of the words "Work Change Directive" is synonymous with "Construction Change Directive".

A.56 *Project Record Documents* - The documents prepared by the Contractor as required by the Contract Documents for use by the Owner for acceptance of the work.

A.57 *Day* - When referred to in the Contract Documents, a Day is defined as a single calendar day.

Delete the Terms,

A.53 *Work Change Directive*

Modifications to Article 2: - PRELIMINARY MATTERS

Paragraph 2.02 - Copies of Documents

Delete the paragraph in its entirety.

Paragraph 2.05 - Before Starting Construction

Delete the paragraph in its entirety. Schedule requirements are identified in Specification Section 01320.

Paragraph 2.06.A - Preconstruction Conference

Replace "in Paragraph 2.05.A" with "in specification section 01320".

Paragraph 2.07 - Initial Acceptance of Schedules

Delete the paragraph in its entirety. Schedule requirements are identified in Specification Section 01320

Modifications to Article 3: - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Paragraph 3.01.D - Intent

Add the following subparagraph:

The Contractor shall abide by and comply with the true intent of the Contract Documents and shall not take advantage of any unintentional error or omission, but shall fully complete every part as the true intent and meaning of the Work as described in the Contract Documents.

SubParagraph 3.03.B.2 - Resolving Discrepancies

Add the following subparagraph:

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2. The Contract Document shall be given precedence in the following order in resolving errors, discrepancies, or ambiguities:
 - a. CCD's (Construction Change Directives)
 - b. Change Orders
 - c. Addenda
 - d. Supplementary General Conditions
 - e. General Conditions
 - f. Specifications
 - g. Drawings and Details
 - h. Written dimensions on plans shall govern over scaled dimensions.
1. Information shown in schedules shall govern over information shown on plans and details.

Modifications to Article 4: - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

SubParagraph 4.01.B -Availability of Lands

Delete the subparagraph in its entirety.

SubParagraph 4.01.C-Availability of Lands

Delete the subparagraph in its entirety.

Modifications to Article 5: - BONDS AND INSURANCE

5.02 *Licensed Sureties and Insurers*

SC-5.02.A Add the following paragraph immediately after Paragraph 5.02.A

- B. Contractor may obtain workers' compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in Maryland, (b) is certified or authorized as a workers' compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects in the state within the last 12 months.

5.03 *Certificates of Insurance.*

SC-5.03.B Delete Paragraph 5.03.B in its entirety.

5.04 *Contractor's Liability Insurance*

SC-5.04.A Delete Paragraph 5.04.A in its entirety and replace with the following paragraph:

Contractor shall purchase and maintain such liability and other insurance as detailed below for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable. The limits of liability for the insurance shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

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SC-5.04.A.1 Delete sub-paragraphs 5.04.1. – 5.04.A.6 in their entirety.

SC-5.04.A.1 Add the following new paragraphs immediately after Paragraph 5.04.A

1. Workers' Compensation, and related coverages [under Paragraphs 5.04.A.1 and A.2} of the General Conditions:

State:		<u>Statutory</u>
Employer's Liability:		
Bodily injury, each accident	\$	<u>1,000,000</u>
Bodily injury by disease, each employee	\$	<u>1,000,000</u>
Bodily injury/disease aggregate	\$	<u>1,000,000</u>
Foreign voluntary worker compensation		<u>Statutory</u>

2. Contractor's Commercial General Liability under Paragraphs 5.04.A.3 and 5.04.A.4 and 5.04.A.5 of the General Conditions:

General Aggregate	\$	<u>3,000,000</u>
Products - Completed Operations Aggregate	\$	<u>3,000,000</u>
Personal and Advertising Injury Each Occurrence (Bodily Injury and Property Damage)	\$	<u>2,000,000</u>

3. Automobile Liability under Paragraph 5.04.A.6. of the General Conditions:

Combined Single Limit of	\$	<u>1,000,000</u>

4. Contractor's Pollution Liability:

Each Occurrence	\$	<u>1,000,000</u>
General Aggregate	\$	<u>2,000,000</u>
☐	If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract	

5. Contractor's Riggers Liability (if a Crane will be utilized):

Each Occurrence	\$	<u>1,000,000</u>
General Aggregate	\$	<u>2,000,000</u>
☒	If box is checked, Contractor is NOT required to provide Contractor's Riggers Liability insurance under this Contract	

This insurance can be included in the General Liability, but certificate of insurance must indicate this coverage. All other insurance requirements will continue to apply.

Coverage may be supplied by sub-contractor with both General Contractor and Frederick County, Maryland added as additional insureds.

6. Contractor's Railroad Liability:

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If box is checked, Contractor is NOT required to provide Contractor's Railroad Liability insurance under this Contract

Provide liability coverage while work is performed on or near the railroad right-of-way. This insurance can be included in the General Liability policy via endorsement, ISO Form CG2417 or similar form, which repeats the definition of an insured contract, but leaves out the restriction for work within 50' of a railroad, thus providing coverage. The Railroad must be named in the schedule and the certificate of insurance must indicate this coverage.

7. Contractor's Professional Liability:

Each Claim	\$	<u>1,000,000</u>
Annual Aggregate	\$	<u>2,000,000</u>



If box is checked, Contractor is NOT required to provide Contractor's Professional Liability insurance under this Contract

Contractor may provide pollution liability and professional liability policies as a hybrid or combined policy.

SC-5.04.B.1 Add the following new paragraphs immediately after Paragraph 5.04.B.1:

- a. The Contractor's commercial general liability, automobile liability, and pollution liability insurance policies shall include and list Frederick County, Maryland as additional insured.
- b. **Certificate of Insurance must state:** "General Liability contains no exclusions for Underground/Explosion/Collapse coverage."

5.06 Property Insurance

SC-5.06.A Add the following to the list of items in Paragraph 5.06.A, as numbered items:

8. include for the benefit of the Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys fees and engineering or other consultants' fees, if not otherwise covered;
9. be subject to a deductible amount of no more than \$5,000 for direct physical loss in any one occurrence.

5.07 Waiver of Rights

SC-5.07 Delete Paragraph 5.07.A through 5.07.C in its entirety and insert the following:

- A. All policies purchased in accordance with Paragraph 5.06, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insured thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
- B. Any insurance policy maintained by the Owner covering any loss, damage, or consequential loss referred to shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers,

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directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

- C. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

Modifications to Article 6: - CONTRACTOR'S RESPONSIBILITIES

Paragraph 6.01 - Supervision and Superintendence

Add the following as Subparagraph 6.01.C,

At any time during the performance of the work or services of the Contract, Owner may request the replacement of any member of Contractor's personnel. Upon receipt of such request, Contractor shall assign a competent, suitably qualified replacement acceptable to the Owner. Owner may also request replacement of any member of any sub-contractor's personnel, and Contractor shall ensure assignment of a competent, suitably qualified replacement.

Paragraph 6.02.B - Labor; Working Hours

Replace the word "Engineer" with "Owner".

Paragraph 6.02.C - Labor; Working Hours

Add the following as Subparagraph 6.02.C,

C. The Contractor will develop the construction schedule based on 5-days per week (Monday through Friday), that begins no earlier than 7:00 am EST and ends no later than 4:00 pm EST. The working hours may be adjusted if requested by the Contractor and approved by DECM.

Paragraph 6.02.D - Labor; Working Hours

Add the following as Subparagraph 6.02.D,

D. The Owner recognizes the following holidays (January 1st, Martin Luther King Day, Memorial Day, July 4th, Labor Day, Veteran's Day, County General Election Day, Thanksgiving, the day after Thanksgiving, December 24th, and December 25th). In the event the named holidays fall on a weekend, the Owner will celebrate the holiday the proceeding day and the Contractor must adjust the construction schedule accordingly. All listed holidays are considered non-work days during the contract duration and must be shown accordingly in the construction schedule. If the Contractor desires to work on a holiday, a request should be submitted to DECM 48 hours in advance of the holiday. DECM is under no obligation to approve the request.

Paragraph 6.04 - Progress Schedule

Delete the paragraph in its entirety. Schedule requirements are identified in Specification Section 01320.

SubParagraph 6.05.A.2 - Substitutes and "Or-Equals"

Delete the subparagraph in its entirety. Substitution requirements are identified in Supplemental Conditions

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Specification Section 01630.

SubParagraph 6.05.B - Substitutes and "Or-Equals"

Delete the subparagraph in its entirety. Substitution requirements are identified in Specification Section 01630.

SubParagraph 6.05.C - Substitutes and "Or-Equals"

Delete the subparagraph in its entirety. Substitution requirements are identified in Specification Section 01630.

SubParagraph 6.05.D - Substitutes and "Or-Equals"

Delete the subparagraph in its entirety. Substitution requirements are identified in Specification Section 01630.

SubParagraph 6.05.E - Substitutes and "Or-Equals"

Delete the subparagraph in its entirety. Substitution requirements are identified in Specification Section 01630.

SubParagraph 6.06.B - Concerning Subcontractors, Suppliers, and Others

Delete the paragraph in its entirety and replace with the following:

If the Bidding Documents require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Bidding Documents, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work

Paragraph 6.08 - Permits

Delete the paragraph in its entirety and Replace with,

The Architect shall apply for and secure the building permit for this project. The Contractor shall secure all other governmental permits, approvals, licenses, and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract, and which are legally required at the time the bids are received. The Owner will pay the cost of fees associated with road footage improvements, road permits, water and sewer tap fees and connection charges, cost of water meter, and electric, telephone, and gas company connection charges and the cost of same shall not be included in the Contractor's bid. The Contractor shall be responsible for coordinating the Work under this Contract with all interested utility companies and inspection agencies. No claim for additional cost or time will be considered as a result of the Contractor's failure to properly coordinate this work.

SubParagraph 6.11.C - Use of Site and Other Areas

In addition to the requirements outlined in the General Conditions, the Contractor is also required to:

1. Thoroughly clean interior building areas when ready to receive finish painting and continue cleaning on an as-needed basis until building is ready for acceptance or

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
Westview Fire Station 31

- occupancy;
2. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process do not fall on wet, newly-painted surfaces;
 3. Allow no waste materials, rubbish, and debris to accumulate and become unsightly, hazardous, or impair the progress of the Work;
 4. Clean all glass and aluminum surfaces;
 5. Repair, patch, and touch-up marred surfaces to match adjacent finishes;
 6. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from interior and exterior surfaces of fixtures, hardware, and equipment furnished as a part of this Contract;
 7. Use only materials and methods for cleaning finish surfaces approved by manufacturers;
 8. Clean up all work areas on a daily basis; and
 9. Shall be responsible for procuring permits and paying all fees for the hauling and dumping of rubbish, waste materials, and debris from the site to area approved by local authorities.

Paragraph 6.14 - Safety Representative

In addition to the requirements outlined in the General Conditions, the Contractor is also required to enforce:

Hard hats will be required at all construction sites included under this Contract from the start to completion of the Work. Each subcontractor, employee, and visitor at any construction site included under this Contract will be required to wear a hard hat. The Contractor shall provide for the supply and shall enforce the wearing of hard hats by subcontractors, employees, and visitors.

Paragraph 6.17 - Shop Drawings and Samples

Delete the paragraph in its entirety. Shop Drawings requirements are identified in Specification Section 01330.

Paragraph 6.18 - Continuing the Work

Delete "except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing."

Modifications to Article 7: - OTHER WORK AT THE SITE

SubParagraph 7.01.A.2 - Related Work at Site

Delete the subparagraph in its entirety.

Modifications to Article 8: - OWNER'S RESPONSIBILITIES

Paragraph 8.01.A- Communications to Contractor

Change the words, "through Engineer." to "through DECM."

Paragraph 8.02 - Replacement of Engineer

Delete the paragraph in its entirety.

Paragraph 8.04 -Pay When Due

Delete the paragraph in its entirety. Payments to the Contractor will be in accordance with specification section 01200.

Modifications to Article 9: - ENGINEER'S STATUS DURING CONSTRUCTION

SubParagraph 9.06.A- Shop Drawings, Change Orders, and Payments

FREDERICK COUNTY DIVISION OF PUBLIC WORKS

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Delete the subparagraph in its entirety. Shop Drawings requirements are identified in Specification Section 01330.

SubParagraph 9.06.D- Shop Drawings, Change Orders, and Payments

Delete the subparagraph in its entirety. Shop Drawings requirements are identified in Specification Section 01330.

Paragraph 9.07 - Determinations for Unit Price Work

Delete the paragraph in its entirety.

SubParagraph 9.08.C - Decisions on Requirements of Contract Documents and Acceptability of Work

Delete the subparagraph in its entirety.

Modifications to Article 10: - CHANGES IN THE WORK; CLAIMS

Paragraph 10.05 - Claims

Substitute "Department of Engineering and Construction Management" (DECM) for all instances where "Engineer" is listed throughout paragraph.

SubParagraph 10.05.B -Claims

Delete last sentence.

SubParagraph 10.05.G-Claims

Add the following subparagraph;

G. Decision of the Department of Engineering and Construction Management (DECM): Claims, including those alleging an error of omission by the Engineer, shall be referred initially to DECM for action as provided in Article 10. A final decision by DECM, as provided in Subparagraph 10.06 C or D of these Supplementary Conditions, shall be required as a condition precedent to arbitration or litigation of a Claim between the Contractor and Owner.

Paragraph 10.06 - Arbitration

Add the following text;

If a Claim has not been resolved pursuant to Paragraph 10.05, the written decision of DECM, including any change in the Contract Sum or Contract Time or both, shall be final and binding on the Contractor, but subject to Arbitration. The Owner reserves the right to notify the surety of the nature and amount of the Claim and may request the surety's assistance in resolving the controversy.

A. In the event of a dispute between the parties to this contract involving \$10,000.00 or more regarding the terms of the contract or performance under the contract, the question involved in the dispute shall be subject to a determination of questions of fact by an officer or official body of the County selected by the Chief Administrative Officer, in their sole discretion, who may include, but is not limited to, any of the Directors of Frederick County Government's Divisions of Public Works, Utilities and Solid Waste Management, or Finance. The decisions of the officer or official body selected by the Chief Administrative Officer to resolve this dispute are subject to review on the record by the Circuit Court of Frederick County.

B. A dispute between the parties to this contract involving less than \$10,000.00 regarding the terms of the contract or performance under the contract shall be determined by an officer or official body of the County selected by the Chief Administrative Officer, in their sole discretion, who may include, but is not limited to, any of the Directors of Frederick County Government's Divisions of Public Works, Utilities and Solid Waste

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Management, or Finance. The decision of the officer or official body selected by the Chief Administrative Officer to resolve this dispute shall be final and binding on the parties to the dispute, and conclusive of the issue.

- C. The only parties to any proceeding to determine a dispute shall be the Contractor and the Owner, unless the Contractor and Owner otherwise agree to allow additional parties.
- D. A request for a determination of a dispute must be filed with the Chief Administrative Officer within 30 days of the determination by DECM, with a copy to the Director of Public Works and the County Attorney.
- E. Unless otherwise agreed, the contractor shall carry on the work and maintain its progress during any dispute proceedings as if no dispute had occurred, and the owner shall continue to make payments to the contractor in accordance with the contract documents for items not subject to the dispute.

Modifications to Article 11: - COST OF THE WORK; ALLOWANCES; UNIT (CONTINGENT ITEM) PRICE WORK

SubParagraph 11.01.A.5.i - Cost of the Work

Rename this paragraph 11.01.B.6. These services are excluded from the Cost of Work.

SubParagraph 11.02.A - Allowances

Delete the words, "and Engineer."

SubParagraph 11.02.D - Allowances

Delete the words, "by Engineer."

SubParagraph 11.03.B - Unit Price Work

Delete the sentence, "Determinations of the actual quantities... provisions of Paragraph 9.07."

SubParagraph 11.03.D- Unit Price Work

Delete the subparagraph in its entirety.

Modifications to Article 12: - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SubParagraph 12.01.A-Change of Contract Price

Change the words "to the Engineer" to "to the Owner".

SubParagraph 12.01.C - Contractor's Fee

Delete the text in its entirety and Replace with;

1. Overhead and profit used in determining adjustments to the Contract Sum shall be calculated as follows:
 - a. The allowable mark-up for combined overhead and profit for Work performed by the General Contractor with their own forces shall not exceed fifteen percent (15%) based upon the labor and material cost of the Work. For Work performed by a Subcontractor with their own forces, the percentages for combined overhead and profit for a Subcontractor will be as stated above. Tax is not permitted to be marked up as part of overhead and profit mark up.
 - b. On Work partly or solely performed by a Subcontractor, the General Contractor will be allowed a maximum of eight percent (8%) of the total cost of the Subcontractor's labor and material costs only. Tax is not permitted to be marked up as part of overhead and profit mark up.

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- c. Overhead and profit rates stated above shall include the cost for additional bond and insurance coverage and cost for preparation and procurement of cost proposals and change orders.
- d. All cost proposals shall include a complete breakdown of material and labor costs showing the material list, unit prices, hours, and applicable pay rates.

SubParagraph 12.02.A- Change of Contract Times

Delete the subparagraph in its entirety and Replace with;

The Contract Times may only be changed by a Change Order.

SubParagraph 12.03.C - Delays

Remove the entire Paragraph and replace with;

C. Weather Delays - Extensions of time, when granted, will be based upon the effect of delays to the Work as a whole. The time extensions due to weather delays will be non-compensable to either party of the contract. Extensions of time will not be granted for non-controlling delays to minor included portions of work unless it can be shown that such delays did, in fact, delay the progress of the Work as a whole. Extensions of time will not be granted until such time as the County is satisfied they are appropriate and justified. Unusually severe weather must be more severe than the inclement weather anticipated for the project location during any given month. The following schedule of monthly anticipated inclement weather delays will constitute the baseline for monthly weather time evaluation. The Contractor's progress schedule must reflect these anticipated inclement weather delays in all weather-dependent activities. If the anticipated inclement weather days are not realized for any particular month, the Owner may execute a change order to remove the scheduled calendar days from the schedule on a non-compensable basis.

Monthly anticipated inclement calendar weather days schedule:

January-7
February- 7
March-8
April- 8
May-8
June-6
July- 6
August-6
September - 6
October- 5
November-6
December - 6.

If inclement weather affects the projects Critical Path, the Contractor shall complete a Weather Delay Request Form supplied by DECM and submit the request to DECM on the day the inclement weather event occurred. The form shall include the type of inclement weather, the CPM activities affected by the weather, if the listed activities are on the Critical Path, and the specific work, which could not be performed. DECM must either concur or deny within 72 hours of receiving the weather delay request. No time extension for inclement weather will be granted until the number of accepted weather delay requests exceeds the anticipated average inclement weather days per month specified in subparagraph 12.03.C.1.a. Weather delays will be evaluated on a monthly basis. If the Weather Delay Request Form is not submitted within 48 hours of the inclement weather day, the contractor waives their right to a time extension.

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ACCEPTANCE OF DEFECTIVE WORK

Sub Paragraph 13.03.D - Tests and Inspections

Delete the subparagraph in its entirety.

SubParagraph 13.07.A- Correction Period

In the first sentence, Replace "within one year" with "within two years".

SubParagraph 13.07.D - Correction Period

Replace "an additional period of one year" with "an additional period of two years".

Modifications to Article 14: - PAYMENTS TO CONTRACTOR AND COMPLETION

SubParagraph 14.01.A- Schedule of Values

Replace "Engineer" with "Owner".

Paragraph 14.02 - Progress Payments

Delete paragraph in its entirety. Payment requirements are identified in Specification Section 01200.

Paragraph 14.04 - Substantial Completion

Delete paragraph in its entirety. Schedule requirements are identified in Specification Section 01770.

Paragraph 14.05 - Partial Utilization Substantial Completion

Delete paragraph in its entirety.

Paragraph 14.06 -Final Inspection

Delete paragraph in its entirety. Schedule requirements are identified in Specification Section 01770.

Paragraph 14.07 - Final Payment

Delete paragraph in its entirety. Schedule requirements are identified in Specification Section 01770.

Paragraph 14.08 - Final Completion Delayed

Delete paragraph in its entirety.

Modifications to Article 15: - SUSPENSION OF WORK AND TERMINATION

Paragraph 15.02.C-Owner May Terminate for Cause

Delete the words "reviewed by the Engineer as to their reasonableness and, when so approved by the Engineer,".

Paragraph 15.04-Contractor May Stop Work or Terminate

Delete paragraph in its entirety.

Modifications to Article 16: - DISPUTE RESOLUTION

Article 16 - Delete Section in its entirety. Refer to Paragraph 10.06 Arbitration

Modifications to Article 17: - MISCELLANEOUS

Paragraph 17.052- Computation of Times

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Westview Fire Station 31

Revise "by the law of the applicable jurisdiction" to "by the law of the State of Maryland in Frederick County".

Paragraph 17.05 - Controlling Law

Revise to reflect the Contract is governed by the law of the State of Maryland in Frederick County.

Modifications to Article 18: - FEDERAL REQUIREMENTS

Delete the Article in its entirety.

Modifications to EXHIBIT GC-A: - CERTIFICATE OF OWNER'S ATTORNEY

Delete the Exhibit in its entirety.

SECTION 00400 – CONTRACT FORMS

ARTICLE 1 - GENERAL

A. The following forms, as listed or set forth in this Section and as described elsewhere in these documents, shall be used as a basis for all required documents. They shall be completed in detail as they apply for the duration of the Contract, shall be prepared by the Contractor in accordance with the particular requirements of this Contract, and shall be submitted to and approved by the Engineer except where otherwise specifically noted in these documents.

ARTICLE 2 - STANDARD EJCDC or AIA FORMS

- A. The latest edition of the following standard forms, as printed and distributed by the Engineers Joint Council Documents Committee (EJCDC) or the American Institute of Architects (AIA).
1. Bid Bond (EJCDC C-430, 2002 Version)
 2. Performance Bond (EJCDC C-610, 2002 Version)
 3. Payment Bond (EJCDC C-615)
 4. Form of Agreement (EJCDC C-521, 2002 Version)
 5. Application and Certificate for Payment (AIA G702, 1997 Version) and Continuation Sheet (AIA G703)
 6. Certificate of Substantial Completion (EJCDC C625 or AIA G704)
 7. Change Order (EJCDC C-941) or form approved and provided by Owner
 8. Contractor's Affidavit of Payment of Debts and Claims (AIA G706) or form approved and provided by Owner
 9. Contractor's Affidavit of Release of Liens (AIA G706A) or form approved and provided by Owner
 10. Consent of Surety to Final Payment (AIA G707) or form approved and provided by Owner
 11. Consent of Surety Company to Reduction In or Partial Release of Retainage (AIA G707A) or form approved and provided by Owner
 12. Construction Change Directive (AIA G714) or Work Change Directive (EJCDC C-940)
 13. Notice of Award
 14. Notice to Proceed

END OF SECTION 00400

AGREEMENT
Frederick County Contract # IFB 26-625-CP
Westview Fire Station 31

THIS AGREEMENT is by and between Frederick County, Maryland ("Owner") and
(Lowest Responsive & Responsible Bidder) ("Contractor").

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 – WORK

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Work of the Westview Fire Station 31 project includes the interior renovation of special function spaces such as the cascade and decon rooms, bunk and locker rooms, lounge and kitchen, offices, and various utility spaces.

ARTICLE 2 - THE PROJECT

- 1.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

Westview Fire Station 31
Frederick County, Maryland

ARTICLE 3 – ENGINEER

- 3.01 The Project has been designed by Manns Woodward Studios, Inc. who is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

- 4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, Final Completion, and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

- 4.02 *Days to Complete the "Work" Identified by the Contract Documents and Obtain Final Payment*

A. The "Work" will be completed within 340 calendar days after the date when the Contract Times commence per the Notice to Proceed, and completed and ready for final payment in accordance with Specification Section 01770 (Closeout Procedures).

- 4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree

that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner \$1,000 (One Thousand Dollars) for each day that expires after the time specified in Paragraph 4.02 for Completion of the “Work” until the “Work” is complete and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A, 5.01.B and 5.01.C, below:

A. For Base Bid Work, Lump Sum Bid Price for renovation of the Westview Fire Station 31:

\$ _____
(figure)

B. For all Unit Contingent Item Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Contingent Item Work times the estimated quantity of that item as indicated in this paragraph 5.01.B:

As provided in Paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by the Owner. Unit Contingent Items have been computed as provided in Paragraph 11.03 of the General Conditions.

<u>CONTINGENT ITEM UNIT PRICE WORK</u>					
<u>Item No.</u>	<u>Description</u>	<u>Unit</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Total Estimated Price</u>
C-1	Earth Excavation – Hand				
C-2	Earth Excavation - Machine				
C-3	Trench Excavation				
C-4	Rock Excavation in Open Cut				
C-5	Trench Rock Excavation				
C-6	Removal from Site of Unsuitable Soil				
C-7	Structural Fill from Off-Site Sources				
C-8	Permanent Seeding, Fertilizing, & Mulch				
C-9	Sod				
C-10	Furnished, Screened Topsoil				
C-11	Light Paving Section				
C-12	Heavy Paving Section				
C-13	Asphalt Adjustment				
C-14	Reinforced Concrete Paving/Pad/Sidewalk				
C-15	4” PVC Conduit	LF	100		
C-16	Hinged Bollards				
C-17	Pipe Bollards	EA	1		
C-18	Pavement Markings (4” Wide)				
C-19	SHA Type A Curb/Gutter				
C-20	2’x2’ Lay-in Ceiling Tile with Grid	SF	100		
C-21	Resinous Flooring	SF	100		
C-22	Carpet Tile	SF	100		
C-23	Base Molding	LF	50		
C-24	Vinyl Wall Cover	SF	200		
C-25	Fire Extinguisher and Cabinet				
C-26	Fire Sprinkler Flex Heads				
C-27	Duplex 120V Electrical Outlet	EA	5		
C-28	Duplex 120V Electrical Outlet, Dedicated	EA	5		

C-29	20AMP, 120V Light Switch	EA	5		
C-30	20AMP, 120V Dimmer Switch 20	EA	5		
C-31	2'x4' Fluorescent Light Fixture	EA	5		
C-32	Emergency Exit Light	EA	5		
C-33	Emergency Exit Sign	EA	5		
C-34	Fire Alarm Pull Station				
C-35	Fire Alarm Horn and Strobe				
C-36	Voice/Data Outlet with Conduit & Box	EA	5		
C-37	Duct Access Door 12"x12"	EA	1		
C-38	Conduit 3/4" for Misc. Wiring, Installed	LF	500		
TOTAL OF ALL UNIT CONTINGENT ITEM WORK					
			(figure)		

TOTAL CONTRACT PRICE
(sum of Base Bid lump sum and total of
Unit Contingent Item Work):

\$ _____
 (use words) (figure)

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the First day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Specification Section 01200 (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may determine or withhold, including but not limited to liquidated damages, in accordance with Specification Section 01200:

A. 95 (Ninety-five) percent of Work completed (with the balance being retainage); and

B. 95 (Ninety-five) percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. In addition to retainage, Owner may withhold from payments otherwise due Contractor any amount that Owner reasonably believes necessary to protect Owner's interest.

6.03 *Final Payment*

- A. Upon receipt of the final Application for Payment accompanied by DECM's recommendation of payment in accordance with Specification Section 01200, Owner shall pay Contractor as provided in Specification Section 01200 the remainder of the Contract Price as recommended by DECM as provided in said Specification Section 01200, less any sum Owner is entitled to set off against DECM's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear no (0%) interest.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.
- E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.
- F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. This Agreement (pages 1 to 7, inclusive);

- B. Invitation for Bids (pages 00020-1 to 00020-4, inclusive);
- C. Instructions to Bidders (pages 00100A-1 to 00100A-11, inclusive)
- D. General Conditions (pages 00300-1 to 00300-56, inclusive);
- E. Supplementary Conditions (pages 00320-1 to 00320-13, inclusive);
- F. Specifications (per Attachment A) as listed in the table of contents of the Project Manual; Drawings (per Attachment B) with each sheet bearing the following general title: Westview Fire Station 31;
- G. Addenda (numbers __ to __, inclusive);
- H. Exhibits to this Agreement (as follows)
 - 1) Contractor's Bid (pages 00410-1 to 00410-5, inclusive);
 - 2) Performance bond (pages 00610-0 to 00610-1 inclusive);
 - 3) Payment bond (pages 00615A-0 to 00615A-1);
 - 4) Unit Price Contingent Items, Attachment A-1;
 - 5) Affidavit of Qualification to Bid;
 - 6) Bidder Certification of Work Capacity;
 - 7) Affidavit;
 - 8) Two Certifications of Compliance;
 - 9) Bid Bond (pages 00430-1 to 00430-2, inclusive);
- I. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - 1) Notice to Proceed,
 - 2) Change Orders
 - 3) Work Change Directives which may be delivered or issued after the effective date of the Agreement.
- J. There are no Contract Documents other than those listed above in this Article 9.
- K. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

- A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in two copies. One counterpart each has been delivered to Owner and Contractor. All portions of the Contract Documents have been signed, initialed, or identified by Owner and Contractor or identified by Engineer on their behalf.

This Agreement is dated _____, 20__.

OWNER: Frederick County, MD

CONTRACTOR: (Lowest Responsive & Responsible Bidder)

By: Justin Hedges

By: _____

Title: Acting Office Director, Office of Procurement and Contracting

Title: President

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

Agent for service of process:

(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
Westview Fire Station 31

SECTION 00450 – CONTRACTOR’S QUALIFICATION STATEMENT

ARTICLE 1 - GENERAL

- A. The Contractor’s Qualifications Statement shall be submitted within three days of Owner’s request.

END OF SECTION 00450

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

Corporation ☐

NAME:

Partnership ☐

ADDRESS:

Individual ☐

PRINCIPAL OFFICE

Joint Venture ☐

Other ☐

NAME OF PROJECT

1. ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

How many years has your organization been in business under its present business name?

Under what other or former names has your organization operated?

If your organization is a corporation, answer the following:

Date of Incorporation:

State of Incorporation:

President's name:

Vice-President's name(s):

Secretary's name:

Treasurer's name:

If your organization is a partnership, answer the following:

Date of organization:

Type of Partnership (if applicable):

Name(s) of general partner(s):

If your organization is individually owned, answer the following:

Date of Organization:

Name of Owner:

If the form of your organization is other than those listed above, describe it and name the principals:

2. LICENSING

2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business and indicate registration or license numbers, if applicable:

2.2 List jurisdictions in which your organization's partnership or trade name is filed:

3. EXPERIENCE

3.1 List the categories of work that your organization normally performs with its own forces.

3.2 Claims and Suits: (If the answer to any of the questions below is yes, please attach details.) Has your organization ever failed to complete any work awarded to it?

Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?

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

- 3.4** On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

3.4.1 State total worth of work in progress and under contract:

- 3.5** On a separate sheet, list three major projects your organization has completed in the past five years, that are of a similar scope of work. All projects must have been completed within the last five years. Provide the name of the project, owner, engineer, contract amount, date of completion and percentage of the cost of the work performed with your own forces. Provide the name and telephone number of an authorized representative of the owner familiar with the project. Unverifiable projects may result in disqualification from this bid.

3.5.1 State average annual amount of construction work performed during the past five years:

- 3.6** On a separate sheet, list the construction experience and present commitments of the key individuals of our organization.
- 3.7** List the names of the subcontractors proposed to complete the *Westview Fire Station Renovation* work required on this contract.

4. REFERENCES

4.1 Trade References:

4.2 Bank References:

4.3 Surety:

4.3.1 Name of Bonding Company:

4.3.2 Name and address of agent:

5. FINANCING

5.1 Financial Statement

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

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

5.1.3 Is the attached financial statement for the identical organization named on page one?

5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsiary).

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

6. SIGNATURE

6.1 Dated at _____ this _____ day of _____, 20__

Name of Organization: _____

By: _____

Title: _____

6.2 _____, being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this _____ day of _____, 20__

Notary Public: _____

My Commission Expires: _____

FREDERICK COUNTY DIVISION OF PUBLIC WORKS
Westview Fire Station 31

SECTION 00600 – BONDS AND CERTIFICATES

ARTICLE 1 - DESCRIPTION

- A. The Bid Bond EJCDC C-430 (Version 2002), herein referred to as the “BID BOND”, Performance Bond EJCDC C610 (Version 2002), herein referred to as the “PERFORMANCE BOND” and Payment Bond EJCDC C615 (Version 2002), herein referred to as the “PAYMENT BOND” shall govern the bidding and execution of the Agreement. A sample copy of EJCDC C-430, EJCDC C-610 and EJCDC C-615 are attached.

END OF SECTION 00600

BID BOND
IFB 26-625-CP
Westview Fire Station 31

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER:

Frederick County, Maryland
12 East Church Street
Fredrick, MD 21701

BID

Bid Due Date:
Project: Bid No. 26-625-CP:
Westview Fire Station 31

BOND

Bond Number:
Date (Not later than Bid due date):
Penal sum

(Words)

(Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

SURETY

(Seal

(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

- 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
- 3.2. All Bids are rejected by Owner, or
- 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

PERFORMANCE BOND
IFB 26-625-CP
Westview Fire Station 31

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

Frederick County, Maryland
12 East Church Street
Frederick, MD 21701

CONTRACT

Date:

Amount:

Description (Name and Location):

IFB 26-625-CP

Westview Fire Station 31

BOND

Bond Number:

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form: None

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

(Space is provided below for signatures of additional parties,
if required.)

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title:

EJCDC No. C-610 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.
2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
 - 3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Owner has agreed to pay the Balance of the Contract Price to:
 1. Surety in accordance with the terms of the Contract;
 2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
 - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
 - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
 1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefore to Owner; or
 2. Deny liability in whole or in part and notify Owner citing reasons therefore.
5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.
6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
 - 6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and
 - 6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.
7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.
8. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
 - 12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
 - 12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone
Surety Agency or Broker
Owner's Representative (engineer or other party)

PAYMENT BOND
IFB 26-625-CP

Westview Fire Station 31

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

Frederick County, Maryland

12 East Church Street

Fredrick, MD 21701

CONTRACT

Date:

Amount:

Description: IFB Agreement 26-625-CP
Westview Fire Station 31

BOND

Bond Number:

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form: None

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

(Space is provided below for signatures of additional parties,
if required.)

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title:

EJCDC No. C-615 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if Contractor:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with Contractor:

1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. RESERVED.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that

all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone

Surety Agency or Broker:

Owner's Representative (engineer or other party):

SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.1 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project Information
 - 2. Contract Description
 - 3. Work by Owner
 - 4. Owner Furnished/Contractor Installed (OFI) Products
 - 5. Owner Occupancy
 - 6. Contractors Use of Site
 - 7. Work Restrictions
 - 8. Specifications and Drawing Conventions
 - 9. Miscellaneous Provisions

1.3 PROJECT INFORMATION

- A. Project Name: Westview Fire Station 31 Interior Renovation.
- B. Project Location: 5525 New Design Road, Frederick, Maryland 21703.
- C. Owner's Name: Frederick County Department of Public Works.
- D. Owner's Location: 155 Montevue Lane, Suite 200, Frederick, Maryland 21702-8213.
- E. Architect's Name: MW Studios.
- F. Architect's Location: 8098 Sandpiper Circle, Suite H, Nottingham, Maryland 21236.
- G. Additional Project contact information is specified in Section 00 0103 - Project Directory.
- H. The Work of the Project is defined by the Contract Documents and generally includes, but is not limited to, the following:

1. The Project generally consists of the interior renovation of the existing Westview Fire Station. Project includes an Alteration Level 2 Interior Renovation. Partial Demolition of interior spaces will occur. Work includes the Reconfiguration of some interior spaces and the application of new finishes as indicated within the drawings. A systemic renovation will be executed including mechanical, plumbing and electrical work. Exterior work generally includes infilling areas of wall where windows or doors are being removed. There is an existing sprinkler system that will be altered to incorporate the scope of work. The station shall remain in operation throughout the construction period. Temporary trailers shall house emergency response staff. Emergency vehicles shall remain housed within the existing apparatus bays of the station during construction. However staff will only briefly occupy the apparatus bays while transitioning from temporary facilities to the vehicles for response purposes..
2. Phased Construction
 - a. The project will be constructed in multiple phases as indicated below. Construct each phase of the project to be substantially complete before proceeding to the next phase of work.
 - 1) Before commencing the work of each phase, submit an updated copy of the Contractor's construction schedule, showing the sequence, commencement and completion dates and move-out and -in dates of Owner's personnel where applicable for all phases of the Work.
 - 2) Phase 1: Phase 1 shall consist of the installation of all temporary trailers and their associated utilities, systems, and other appurtenances required to provide complete, operational, an occupiable temporary facilities such that the fire department can continue their daily operations and emergency response services.
 - 3) Phase 2: Phase 2 shall consist of the renovations and alterations to the existing facility.
 - 4) Phase 3: Phase 3 shall consist of the removal of all temporary facilities and the patching, repairing, and replacement of existing construction affected by such facilities.
- I. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage of this Project.
 1. See Section 01 3000 - Administrative Requirements for requirements for obtaining and utilizing web-based Project Software.

1.4 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price.

1.5 WORK BY OWNER

- A. Cooperate fully with Owner/Owners Contractors, so work may be carried out smoothly, without interference with or delaying Work under this Contract or work by Owner/Owners Contractors. Coordinate the Work of this Contract with work performed by Owner/Owners Contractors.

1.6 OWNER FURNISHED/CONTRACTOR INSTALLED (OFICI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 1. Provide to Contractor Owner reviewed Product Data, Shop Drawings, and Samples.
 2. Provide for delivery of Owner furnished products to Project Site.
 3. Upon delivery, the Owner will inspect, with the Contractor present, the delivered item(s).
 - a. If Owner furnished products are damaged, defective, or missing, the Owner will arrange for replacement.

4. Owner will obtain manufacturer's inspections, service, and warranties.
5. Owner will inform the Contractor of earliest available delivery date for Owner furnished products.
- B. Contractors Responsibilities: The Work includes the following, as applicable:
 1. Identify delivery dates of Owner furnished products in Contractors construction schedule, utilizing Owner furnished earliest available delivery dates.
 2. Review Owner reviewed Product Data, Shop Drawings, and Samples noting discrepancies and other issues in providing for Owner furnished products in the Work.
 3. Receive, unload, handle, store, protect, and install Owner furnished products.
 4. Make building services connections for Owner furnished pro
 5. Protect Owner furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 6. Repair or replace Owner furnished products damaged following receipt and prior to Substantial Completion.
- C. Owner Furnished Contractor Installed (OFCI) Products:
 1. Items shall be as indicated on drawings.

1.7 OWNER OCCUPANCY

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Schedule/Perform the Work so as not to interfere with Owner's operations.
 1. Maintain existing exits unless otherwise indicated.
 2. Maintain access to walkways, corridors, or other occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 3. Notify Owner not less than five business days in advance of activities that will affect Owners operations.
- B. Owner intends to occupy the Project upon Substantial Completion.

1.8 CONTRACTOR USE OF SITE AND PREMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
 1. Limits on Use of Site: Limit use of Project site to areas within Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 2. Construction Operations: Limited to areas noted on Drawings.
 3. Construction Personnel Parking:
 - a. Construction personnel shall not be allowed to utilize the Project site for parking of personal vehicles. Construction personnel shall be required to find and utilize legal offsite parking.
 4. Material Storage and Fabrication Areas: Limit material storage and fabrication areas to those areas indicated on drawings or as directed by Owner/Architect. Schedule deliveries and fabrication times to minimize time requirements and space requirements within the designated areas.

- B. Driveways, Walkways and Entrances: Keep driveways, parking garages, loading zones/areas, entrances, emergency vehicle response paths, and walkways serving premises clear and available to Owner, Owner's employees, and emergency services at all times. Do not use these areas for parking or for storage of materials.
 - 1. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - 2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Arrange use of useable/allowable portions of site and premises to facilitate:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
 - 4. Use of site and premises by the public.
- D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- E. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of Project site and premises.
 - 2. Comply with limitations on use of public streets, work on public streets, rights of ways, and other requirements of authorities having jurisdiction.
 - 3. Provide access to and from site as required by law, by authorities having jurisdiction, and by the Owner.
 - 4. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 5. Existing building spaces may not be used for storage.
- B. Time Restrictions: Limit work between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
 - 1. Weekend Hours: Restricted to Owner Approval; Provide minimum 5 days notice to Owner.
 - 2. Early Morning Hours: Restricted to Owner Approval; Provide minimum 5 days notice to Owner.
 - 3. Work in Existing Building: In other than designated work areas, restricted to Owner Approval; Provide minimum 5 days notice to Owner.
- C. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors or other disruptions to Owner occupancy with Owner.
 - 1. Limit conduct of especially noisy, malodorous, and dusty work to daytime work hours indicated above..
- D. Utility Outages and Shutdown:

1. Do not disrupt or shut down utility services without 7 days notice to Owner and written permission from the Owner. Utility shut downs shall be limited to patching over temporary utility services and shall be as short as possible.
 2. Prevent accidental disruption of utility services to other facilities.
- E. Smoking and Controlled Substances
1. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air-intakes.
- F. Employee Identification and Screening
1. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
 2. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 - a. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are typically identified by the typical generic terms used in the individual Specifications Sections. Some products and materials may be defined on the Drawings.
 2. Abbreviations: Materials and products may be identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard. Where discrepancies exist between the drawings and the U.S. National CAD Standards, the drawings shall prevail.
 3. Keynoting: Materials and products may be identified by reference keynotes referencing Specification Section numbers found in this Project Manual/Specification.

1.11 MISCELLANEOUS PROVISIONS

- A. Contractors shall be responsible for ensuring all sub-contractors contracted to perform a portion of the Work have possession of ALL CONTRACT DOCUMENTS. Sub-contractors shall be responsible for reviewing all Contract Documents including but not limited to Drawings and Specifications and providing all items outlined within the documents to be provided along with all connections, systems, supports, and miscellaneous items required for the items to function properly as intended.
- B. Drawing Coordination: Generally, requirements for materials and products identified on the Drawings are described in detail within the Specifications. However, items may be indicated either only on the Drawings or only within the Specifications. If items are indicated in one document only, it shall be the responsibility of the Contractor to provide the item indicated along with all the components, connections, systems, supports or other miscellaneous items required for the proper operation and installation of the items identified within the single document.
- C. References within the Drawings and/or Specifications to other Drawings and/or Specifications indicates the potential existence of additional information. If no additional information exists within the referenced drawing(s) or specification(s), the Contractor shall remain responsible for the installation of the Work indicated or graphically depicted. Where Work typically would be structural or load bearing in nature, the Contractor shall provide reinforcement, bracketing, bracing, or otherwise attach such Work as indicated within similar details existing within the Drawings and/or Specifications. It is also the Contractor's responsibility to seek clarification for such items prior to submitting a bid to perform the Work. If no clarification is requested for such submission of a bid, it shall be deemed that the Contractor understands the extent of Work both indicated and graphically depicted and has included such within the Contract Sum.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 1000

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.2 RELATED REQUIREMENTS

1.3 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, unless otherwise stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual to establish line items for the schedule of values. Provide at least one line for each Specification Section. Identify each line item with number and title of the specification section. Owner reserves the right to require line items of the schedule of values be broken down further as may be required to satisfy the Owner.
 - 1. Coordinate line items required to be indicated as separate activities or line items by individual Specification Sections of this Project Manual or Contractor's Construction Schedule.
 - 2. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. When required by Owner, include evidence of insurance.
 - 3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules within the Schedule of Values showing values coordinated with each separate element of Work.
- F. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise Schedule of Values to list approved Change Orders, with each Application For Payment.

- H. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's construction schedule and other administrative forms and schedules including but not limited to the following:
 - 1. Application for Payment forms with continuation sheets.
 - 2. Submittal Schedule

1.4 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement. Where not stipulated within the Agreement, the period covered by each Application for Payment shall be one month beginning on the first day of the month and ending on the last day of the month.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Work in Place and Stored Materials of Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- F. Execute certification by signature of individual authorized to sign legal documents on behalf of the Contractor and notarize.
- G. Use data from approved updated Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 - 1. Amount indicated within Application for Payment for stored materials shall not include overhead and profit.
- H. Stored Materials: Include the following information with each Application for Payment where amounts are applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; DO NOT include overhead and profit on stored materials.

- I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- J. Submit one electronic and three hard-copies of each Application for Payment.
- K. Include the following with the Initial Application for Payment: The Initial Application for Payment will not be approved until all items below are provided.
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. List of Subcontractors Owning more than 5% of the Contract Sum.
 - 3. Schedule of Values.
 - 4. Contractor's construction scheduled.
 - 5. Submittal schedule.
 - 6. Certificates of Insurance and Insurance Policies.
 - 7. Performance and Payment Bonds
 - 8. Information required from Contractor for the aquisition of Owner's insurance.
- L. Each Application for Payment following the Initial Application for Payment shall be consistent with the previous Applications for Payment as certified by the Owner/Architect and paid for by the Owner. Include the following with each subsequent Application for Payment:
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Current construction photographs specified in Section 01 3000.
 - 4. Partial release of liens from major subcontractors and vendors.
 - 5. Project record documents as specified in Section 01 7800, for review by Owner which will be returned to the Contractor.
 - 6. Affidavits attesting to off-site stored products.
- M. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.5 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor in the form of an ASI or Architects Supplemental Instruction.
- C. For other changes involving an adjustment to the Contract Sum or Contract Time, with the exception of a Construction Change Directive, whether initiated by Owner/Architect or by Contractor, the Contractor shall be required to submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - 1. A request for a change proposal by the Owner/Architect are not instructions to either stop work in progress or to execute the proposed/requested change.
- D. Construction Change Directive: For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.

1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 2. The Contractor must promptly execute the change.
- E. Owner/Architect Initiated Proposal Requests: For changes in which advanced pricing is desired, Architect will issue a document that includes a detailed description of a proposed change which may include supplementary or revised drawings and specifications. Contractor shall prepare and submit a fixed price quotation within 14 calendar days.
- F. Contractor Initiated Proposal Requests: Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.
- G. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 4. For change ordered by Architect without a quotation from Contractor, Construction Change Directive, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- H. Substantiation of Costs: Provide full information required for evaluation and directly attributable to the change.
1. Provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Delivery charges, equipment rental, and amount of trade discounts.
 - d. Overhead and profit.
 - e. Justification for any change in Contract Time.
 - f. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- I. Execution of Change Orders: Upon Owners approval of a Change Order, the Architect will issue AIA Document G701 for signatures of parties as provided in the Conditions of the Contract.
- J. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

- K. After execution of Change Order, promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- L. Promptly enter changes in Project Record Documents.

1.6 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 7000.
 - 2. Evidence of completion of Project closeout requirements.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. Fully executed AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - 5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2000

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SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedural and administrative requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

- A. Section 00 2113 - Instructions to Bidders: Restrictions on timing of substitution requests.
- B. Section 01 2501 - Substitution Request Form: Required form for substitution requests made both prior to (During Procurement) and after (During Construction) award of contract.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability of product or material and/or required warranty terms.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.
 - b. Consideration and review time by the Owner, Architect or other Owner agent or consultant of the substitution for convenience shall not be cause for delay of the Project. Substitution for Convenience requests shall be made by the Contractor with sufficient review time as to not affect the schedule or the progression of the Work. Where a response to a request for review of a substitution for convenience is not received by the Contractor from the Owner, Architect, or Owner's other agent or consultant, the Contractor shall be responsible for providing the Work required by the Contract Documents such that the Work does not delay the Project.
- B. Compatibility: Compatibility of any substitution shall be cause to reject the substitution proposed by the Contractor. Compatibility shall be determined by the Architect and/or Owner at the time of the substitution request. Products shall not be compatible if the products require the Owner to purchase or maintain attic stock, maintenance stock or replacement parts of two different products that perform the same function.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner for owners consultants and agents fees for review or redesign services associated with re-approval by all authorities having jurisdiction.
 - 7. Agrees to reimburse Owner for owners consultants and agents fees for design/redesign services associated with the substitution that are apparent at the time of the substitution or become apparent after the substitution has been accepted.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. It is the responsibility of the substitution proposer to provide a concise substitution request with required relevant information only. **Substitution requests including irrelevant and/or excessive information shall be rejected and returned without review.**
 - 2. Forms included in the Project Manual must be used for the submission of a substitution request. Where form is insufficient to provide the required information provide supplemental sheets, drawings, forms, and/or attachments indicating required information and indicate on the required form the title and location, within the substitution request packet, of additional/supplemental sheets, drawings, forms, and/or attachments.
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 5) Description of Substitution.

- 6) Reason why the specified item cannot be provided.
 - a) Where reason for substitution is in whole or in part due to lead times or availability of the specified products, Contractor shall provide letter on manufacturer's letter head stating the following:
 - (1) Date of purchase order request or initial contact by Contractor for specified product.
 - (2) Lack of availability or extent of lead time as of the date indicated above.
 - (3) Reason for delivery delay.
- 7) Differences between proposed substitution and specified item.
- 8) Description of how proposed substitution affects other parts of work.
 - a) Include list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate Contractors, including design consultants, that will be necessary to accommodate proposed substitutions.
- c. Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) Operational and maintenance clearances.
 - 3) In-service performance.
 - 4) Expected durability.
 - 5) Visual effect.
 - 6) Sustainable design features.
 - 7) Warranties.
 - 8) Compatibility with other items including, but not limited to, Owner's existing and proposed equipment, products, systems, and/or assemblies.
 - 9) Other salient features and requirements.
 - 10) Include, as appropriate or requested, the following types of documentation:
 - a) Product Data:
 - b) Samples.
 - c) Certificates, test, reports or similar qualification data.
 - d) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
 - 1) Cost of Substitution: Indicate the total cost of the substitution.
 - 2) In addition to the total cost of the substitution, provide the following:
 - a) Total deduct or cost savings to the contract price or the total additional cost to the contract price.
 - b) Total Substitution cost shall also be broken down to indicate the following:
 - (1) Material cost.
 - (2) Labor cost.
 - (3) Overhead and profit or fee for each contractor.
 - (4) Required engineering and/or architectural design/redesign fees including but not limited to resubmission to authorities having jurisdiction for approval of permits or similar regulatory items.
 - 3) Change of Contract Time due to accepting substitution. Indicate total deduction or addition of time to the contract including but not limited to any time for design/redesign and/or AHJ approval processes.

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

1. Submit an electronic document, combining the request form with supporting data into single document.
 - a. Electronic document shall be submitted in .pdf format and shall be bookmarked to easily navigate to each major item provided within the request.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Section 00 2600 - Procurement Substitution Procedures specifies procedures and administrative requirements for substitution requests made prior to the award of contract (During Procurement).

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 1. Submit substitution requests by completing 01 2501 - Substitution Request Form. See this section for additional information and instructions. Use only the form indicated; other forms of submission are unacceptable.
- B. Submit request for a Substitution for Cause immediately upon discovery of need for substitution, but not later than 30 calendar days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions for Convenience will not be allowed unless otherwise indicated.
- D. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner but not later than 7 calendar days from the date of the request for additional information.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.5 ACCEPTANCE

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

3.6 CLOSEOUT ACTIVITIES

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

END OF SECTION 01 2500

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SUBSTITUTION REQUEST FORM:

Project: Owner's Name - Global Substitution Request No.: _____
MWS - Private - General Master From: _____
To: _____ Date: _____
Architects Project No. 00-000
Re: _____

Specification Title: _____ Description: _____
Section No. _____
Page No. _____ Article _____

Proposed Substitution: _____
Manufacturer: _____ Website URL: _____
Trade Name: _____ Model No: _____
Installer: _____ Phone No. _____
Differences between proposed substitution and specified product: _____

Provide point by point comparative data on separate sheet as attachment to this form. (This is required for review of any substitution.)

Reason for not providing specified item: _____

Similar Installation: _____
Project: _____ Architect: _____
Address: _____ Owner: _____
Does proposed substitution affect other Work? [No] [Yes] (Explain) _____

Total Cost of Substitution: _____ Dollars: \$ _____
Cost change to contract: [Deduct] [Addition] _____ Dollars: \$ _____
Schedule Impact: [Deduct] [Addition] _____ days.
Does Substitution Require Redesign: [No] [Yes]

Submitting Representative Initials: _____

THE UNDERSIGNED CERTIFIES:

- The proposed substitution has been fully investigated by the General Contractor and determined to be equal or superior in all respects to the specified materials, products, assemblies, and/or equipment as may be applicable to the substitution request.
- General Contractor acknowledges that this proposed substitution must also meet the design intent expressed in the Contact Documents, as judged by the Architect and substantiated by the materials submitted herewith.
- General Contractor will furnish the same warranty for proposed substitution as for specified material, product, assembly, and/or equipment as may be applicable to the substitution request.
- General Contractor has verified that the same level of maintenance service and similar availability of replacement parts, as applicable, is available.
- General Contractor has verified that the proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above and further broken out on supplemental data sheets where attached is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent will be waived by the General Contractor.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made by the General Contractor for changes to building design, including A/E design, detailing, and construction costs caused by this substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be completed by the General Contractor.

Submitted By (Printed Name):

Signature:

On Behalf of (Company Name):

Address:

E-mail Address

Attachments:

ARCHTIECT'S REVIEW AND ACTION

Substitution Approved
Substitution Approved as Noted
Substitution Rejected

Architect: MW Studios, Inc.

Reviewed By:

Signature:

Date:

END OF SUBSTITUTION REQUEST FORM

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General administrative requirements.
- B. Web-based project software service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Coordination drawings.
- J. Submittal Schedule
- K. Submittals for review, information, and project closeout.
- L. Number of copies of submittals.
- M. Requests for Information (RFI) procedures.
- N. Submittal procedures.

1.2 RELATED REQUIREMENTS

- A. Section 01 2000 - Price and Payment Procedures: Administrative procedures for applications for payment.
- B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01 3001 - Submittal Review and Transmittal Form": Form for the response of submittals indicating Architect's Action and related requirements.
- D. Section 01 6000 - Product Requirements: General product requirements.
- E. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- F. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Information (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Delegated Designs; signed and sealed.
 - 7. Manufacturer's instructions and field reports.
 - 8. Applications for payment and change order requests.
 - 9. Progress schedules.
 - 10. Coordination drawings.
 - 11. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 12. Closeout submittals.
- C. Tracking and notification of expiring permissions, permits, and similar regulatory documentation and allowances.
 - 1. Contractor shall be responsible for identifying the expiration dates for and deadlines/time frames for application of extensions of all regulatory permissions including but not limited to grading permits and building permits. The milestones shall be included within the Contractor's Construction/Progress Schedule.
 - 2. Contractor shall notify the Owner and the Architect in writing of approaching deadlines for renewal/extension of regulatory permissions and expiration dates of regulatory permissions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 WEB-BASED PROJECT SOFTWARE SERVICE

- A. Web-Based Project Software Service: Contractor shall provide, administer, and utilize web-based project software to host and manage project communication and documentation.
 - 1. Software shall be capable of performing, at minimum, the following features:
 - a. Project directory, including Owner, Contractor, subcontractors, Architect, Architect's consultants, and other entities involved in the project. Include names of contact persons and contact information for each entity.
 - b. Access control for each entity and for each workflow process to determine each entity's digital rights to create, modify, view, and print documents.
 - c. Workflow planning, allowing customization of workflow for each project entity.
 - d. Creation, logging, tracking, and notification for project communications.
 - e. Tracking of project communication statuses in real time, including timestamped response log.
 - f. Procedures for viewing PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.

- g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creation and distribution of meeting minutes.
 - j. Document management for drawings, specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility.
 - m. Creation of data analytics reports.
 - n. Creation and export of editable logs for software functions. Provide Owner, Architect, and Architect's consultants with rights and ability to download logs when requested.
2. Cost:
- a. Contractor shall pay for the cost of the service and shall include all necessary user licenses.
 - 1) Contractor shall include the cost of the service in the Contract Sum.
 - 2) Comply with the software service's current published licensing agreements.
 - b. Contractor shall pay for up to 10 user licenses for use by Owner, Architect, Architect's consultants, Owner's other Consultants, and other entities involved in the Project.
3. Training: Contractor shall provide one-hour, web-based training session for users of software service. Further training shall be the responsibility of the user.
- a. Representatives of Owner shall be scheduled and included in this training.
4. Project Closeout: Owner determines when to terminate the software service for the project. Contractor shall be responsible for obtaining archive copies of files for Owner.
5. Web-Based Project Software Services: Use one of the following:
- a. Autodesk, Inc.; Build
 - b. Procore Technologies, Inc; Procore
 - c. Newforma, Inc; Newforma Project Center (NPC) with Newforma Info Exchange (NIX):
www.newforma.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

3.2 PRECONSTRUCTION MEETING

- A. Contractor shall schedule meeting prior to starting construction, at a time convenient to Owner and Architect, but not later than 15 days after execution of the Agreement.
- B. Conduct the conference to review responsibilities, personnel assignments and coordination of Project requirements.
- C. Attendees: Authorized representatives of Owner and Architect and their consultants; Contractor and its' superintendent; Major subcontractors; and other concerned parties shall attend the meeting. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Agenda:
 - 1. Review of portions of the executed Owner-Contractor Agreement affecting the interaction and coordination between the Contractor and the Architect.
 - 2. Verify and Review the submission of executed bonds and insurance certificates.
 - 3. Verify date and version of Contract Documents included within the Owner-Contractor Agreement.
 - 4. Identify/Designate key personnel and their duties.
 - 5. Establish communication hierarchy and requirements.

6. Review Construction Schedule, including a discussion of phasing where applicable, critical work sequences, long lead product procurement.
 - a. Establish date/time of re-occurring progress meeting.
 7. Submission of initial Submittal schedule.
 8. Procedures and processing of field decisions, RFI's, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - a. Discuss submittal procedures. Modify submittal separation or combination of submittals for the purposes of transmitting individual or combined submittals of each Specification Section within a single or multiple transmittals. All requirements for related submittal submissions shall remain unmodified/unchanged.
 9. Record Document preparation and procedures.
 10. Use of Project site and premises.
 - a. Parking
 - b. Security
 - c. Deliveries, material storage, lay down, and fabrication areas.
 - d. Temporary Facilities
 11. Work Restrictions.
 - a. Work Hours.
 - b. Utility shut downs.
 - c. Noisy, malodorous, and dusty work.
 12. Owner Occupancy
 13. Progress cleaning.
- E. Architect shall record minutes and post copies to web-based document management software within five days after meeting.

3.3 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meetings at Project Site before each construction activity that requires coordination with other construction and as identified in individual specification sections.
- B. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installation that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of scheduled meeting time/date.
- C. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements of/for the following:
 1. Contract Documents
 2. Related RFI's
 3. Related Change Orders or other modifications to the Contract Documents.
 4. Submittals marked other than Rejected, Revised and Resubmit, or Returned Without Action.
 5. Review of mock-ups.
 6. Possible conflicts and compat
 7. Schedules.
 8. Weather limitations.
 9. Manufacturer's information; Written instructions and recommendations, warranty requirements.
 10. Acceptability of substrates.

- 11. Coordination with other work.
- 12. Protection of other work and existing improvements.

- D. Do not proceed with installation if the meeting cannot be successfully concluded. Initiate actions necessary to resolve impediments to performance of the Work and reconvene the meeting at the earliest possible date/time.
- E. Contractor shall record minutes and post copies to web-based document management software within five days after meeting.
 - 1. Record significant meeting discussions, agreements, and disagreement, including required corrective measures and actions.

3.4 PROGRESS MEETINGS

- A. Shall be coordinated and scheduled at the PreConstruction Meeting and shall be administered throughout progress of the work at bi-monthly (every two weeks) intervals.
- B. Architect will make arrangements for meetings and preside at meetings.
- C. Attendees: Owner/Owner Representative, Architect, General Contractor, and other approved guests; Approved guests shall include any representative of an entity familiar with the project authorized to conclude matters relating to the Work that has been requested to attend and approved by either the Architect or the Owner.
- D. Agenda for progress meetings shall set by the previous meeting minutes and shall consist of the following:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of RFIs log and status of responses.
 - 7. Review of off-site fabrication and delivery schedules.
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.
 - 10. Planned progress during succeeding work period.
 - 11. Coordination of projected progress.
 - 12. Maintenance of quality and work standards.
 - 13. Effect of proposed changes on progress schedule and coordination.
 - 14. Other business relating to work.
- E. Architect shall record minutes and post copies to web-based document management software within five days after meeting.
- F. Construction Schedule Update: Contractor shall revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized during the Progress Meeting. Contractor shall post copies of revised schedule to web-based document management software within three days after the meeting.

3.5 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216 - CONSTRUCTION PROGRESS SCHEDULE

3.6 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. In addition to transmitting electronically a copy to Owner and Architect, maintain on-site a daily report log with printed copies of every daily report.
- C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. List of subcontractors at Project site.
 - 4. List of separate contractors at Project site.
 - 5. Approximate count of personnel at Project site.
 - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, helpers, and others.
 - 6. Major equipment at Project site.
 - 7. Material deliveries.
 - 8. Safety, environmental, or industrial relations incidents.
 - 9. Unusual events (submit a separate special report).
 - 10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 11. Services connected and disconnected and meter readings and similar recordings.
 - 12. Emergency procedures implemented.
 - 13. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 - 14. Change Orders received and implemented.
 - 15. Testing and/or inspections performed.
 - 16. List of verbal instruction or Construction Change Directives given by Owner and/or Architect.
 - 17. List of and partial completions or occupancies.
 - 18. Signature of Contractor's authorized representative.
- D. Site Condition Reports: Immediately upon discovery of a difference between site conditions and the Contract Documents, summarize discrepancy within daily report and prepare and submit a separate detailed report to the Architect. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

3.7 PROGRESS PHOTOGRAPHS

- A. Progress photographs shall include Pre-construction photographs, progress photographs, and Final completion construction photographs.
- B. Digital Photographs:

1. Digital Device: Camera or other device capable of producing a minimum of 4 megapixel digital photographs.
 2. Format: Minimum 2688 x 1520 pixel layout/size, in unaltered original files, with same aspect ratio as produced by the sensor, and uncropped.
 3. Identification and Storage: Digital photographs shall contain time, date, and GPS metadata and shall be labeled and shared as follows:
 - a. Digital files shall be named with sequential number and date the image was taken.
 - b. Digital files shall be uploaded to web-based document software weekly unless photographs are intended to be utilized for immediate discussion and coordination.
 4. Usage Rights: Photographer shall release/transfer copyright usage rights to Owner, Architect, and Contractor for unlimited reproduction and photographic documentation.
- C. Preconstruction Photographs: Before starting construction operations, take photographs of Project site, surrounding properties, existing items to remain undisturbed, and existing items to be salvaged, from different vantage points.
1. Flag construction limits before taking pre-construction photographs.
 2. Take photographs to show existing conditions adjacent to property, adjacent to limits of disturbance, and adjacent to areas of work before starting the Work.
 3. Take photographs of existing buildings both located on the property where work is being performed and on adjacent properties to accurately record the physical conditions at the start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Construction Progress Photographs
1. Architect-Directed Construction Photographs: At the Architects discretion, the Architect shall direct the Contractor to take construction progress photographs of ongoing construction activities or in-place construction. The Architect shall provide direction on number of photographs, subject of photographs, vantage points, and other required information to provide the Architect with appropriate detail for coordination or utilization of digital imagery.
 2. Contractor Initiated Construction Photographs: Contractor shall take photographs of ongoing construction activities or in-place construction as may be necessary to coordinate construction activities, assist in the resolution of RFI's or other similar correspondence and information items.
 3. In addition to periodic, recurring views, take photographs of each of the following events:
 - a. Completion of site clearing.
 - b. Excavations in progress.
 - c. Foundations in progress and upon completion.
 - d. Structural framing in progress and upon completion.
 - e. Enclosure of building, upon completion.
 - f. Final completion, minimum of thirty (30) photos.

3.8 COORDINATION PROCEDURES, GENERAL

- A. Each Contractor (Prime/General Contractor(s), Subcontractors, and Suppliers) shall be responsible for the coordination of the Work as it pertains to or has an affect/effect on their Work. Each contractor shall be required to participate in the coordination process. The Contract Documents do not specify, beyond major contract packages of a multi-prime Project, specific items or areas of subcontractor responsibility. It is each Contractor(s) (Prime Contractor(s) and General Contractor(s)) responsibility to perform all the Work of the Contract Documents and assign portions of such work to Subcontractors as they deem necessary.

1. Where Work has been split between multiple subcontractors, suppliers, installers, the Prime/General Contractor shall be responsible for coordinating and combining the submission of submittals for systems and/or portions of systems such that the Architect can review each portion with its related components. The Architect shall notify the Prime/General Contractor if additional information or additional submittals are required and when the submittal(s) received was not properly coordinated or if it was/were received with insufficient information to complete a review. Submittal review time shall not start until a coordinated and complete submission of submittals is received by the Architect.
- B. Coordinate construction operations included in different Sections of the Specifications/Project Manual to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends upon installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair/replacement.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare notice/memorandum for distribution to each party involved, outlining special procedures required for coordination. Include such items including but not limited to, required notices, reports, Specification Sections, and list of attendees at meetings.
 1. Prepare similar notice/memorandum for Owner and separate contractors if coordination of their Work is effected/affected by or effects/affects the Work.

3.9 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to the requirements in individual Sections. Furthermore, prepare coordination drawings where installation of the Work is not completely shown on Shop Drawings, where limited space availability necessitates coordination, where coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity, or where the installation of systems indicated to be diagrammatically represented must integrate with systems or materials that require specific dimensional/spatial installation requirements.
- B. Content: Project specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Where digital files of Contract Documents are utilized to create coordination drawings, the Contractor shall be responsible for integrating actual field conditions known at the time of development of the coordination drawings along with submittal information marked *Approved* or *Approved, Comments Noted* or similar marking. Coordination drawings shall at a minimum include the following as may be applicable:
 1. Plans, sections, elevations, and details required to describe the relationship of various systems and components required to be integrated with one another.
 2. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 3. Indicate space requirements for routine maintenance and for anticipated replacement of components during life of the installation.
 4. Show location and size of access doors required for access to concealed dampers, valves, and controls.
 5. Indicate required installation sequence.

6. Indicate critical dimensions shown on drawings. Specifically note dimensions that appear to be conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- C. Review drawings prior to submission to Architect.

3.10 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
 1. Where RFI's responses will affect the project schedule critical path, submit requests immediately upon discovery.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716 - Request for Information .
 3. Combine RFI and its attachments into a single electronic file. RFI and attachments shall be provided in PDF format. Other formats may be acceptable must must be approved by the Architect prior to submission.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response will be returned without a response.

4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question will be returned without a response.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
 5. RFI's submitted by other than the General Contractor: Requests not submitted by the General Contractor will be returned without a response.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within a reasonable time frame as may be applicable to the RFI content and resolution of RFI issues. If the response of an RFI requires more than fourteen (14) calendar days, the design team shall notify the Contractor of the anticipated response time. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses (Architect's Action):
1. Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly (within fourteen (14) calendar) issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 2. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

3. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
4. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
5. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.11 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
- B. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
 1. Include/Indicate submittals required during the first 60 days of construction as well as those submittals with long lead times for manufacturing and fabrication.
- C. Coordinate with Contractor's construction schedule and schedule of values.
- D. Format schedule to allow tracking of status of submittals throughout duration of construction.
- E. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
- F. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 1. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
 2. Where Work has been split between multiple subcontractors, suppliers, installers, the Prime/General Contractor shall be responsible for coordinating and combining the submission of submittals for systems and/or portions of systems such that the Architect can review each portion with its related components. The Architect shall notify the Prime/General Contractor if additional information or additional submittals are required and when the submittal(s) received was/were not properly coordinated or if it was received with insufficient information to complete a review. Submittal review time shall not start until a coordinated and complete submission of submittals is received by the Architect.
 3. Submittals requiring selection of colors will not be fully reviewed until all related items requiring color selection are submitted respectively. Furthermore, no colors shall be selected until the Owner has selected a color scheme based upon the submitted samples of finishes.
 - a. For example: no exterior color selections shall be made until samples of all exposed materials on the exterior of the building have been submitted, color boards presented to the Owner and the Owner has selected/approved the finish selections presented on the color board(s).

3.12 SUBMITTALS FOR REVIEW

- A. Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "Action Submittals" or "Submittals for Review".
- B. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Delegated Design Data
 - a. Signed and sealed documents, drawings, and calculations.
 - 3. Shop drawings.
 - 4. Samples for selection.
 - 5. Samples for verification.
- C. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- D. Samples will be reviewed for aesthetic, color, or finish selection and texture.
- E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.13 SUBMITTALS FOR INFORMATION

- A. Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Information submittals are those submittals indicated in individual Specification Sections as "Information Submittals" or "Submittals for Information".
- B. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Sustainability design submittals and reports.
 - 3. Certificates.
 - 4. Test reports.
 - 5. Inspection reports.
 - 6. Manufacturer's instructions.
 - 7. Manufacturer's field reports.
 - 8. Field engineering daily reports.
 - 9. Other types indicated.
- C. Submit for Architect's knowledge as contract administrator or for Owner.

3.14 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.

- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.15 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one original electronic copy in PDF format; an electronically-marked up file of the Contract Documents is not acceptable and will be returned unless specifically noted otherwise. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Copies at Project Closeout: See Section 01 7800.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.16 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Unless otherwise discussed and approved by the Architect and the Owner at the PreConstruction Meeting, use a separate transmittal for each item of a Specification Section.
 - 2. Unless otherwise discussed and approved by the Architect and the Owner at the PreConstruction Meeting, submit separate packages of Submittals for Review and Submittals for Information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use form generated by Electronic Document Submittal Service software. Where no form is generated by the Electronic Document Submittal Service or Document Management Service, use Contractor's form, subject to prior approval by Architect.
 - b. Transmittal shall indicate at a minimum, the following information:
 - 1) Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - 3) Category and Type of Submittal
 - a) Category: Submittal for Review or Submittal for Information
 - b) Type: Product Data, Shop Drawings, Samples, Warranty Information, Design Data, etc.
 - 4) Submittal Number; Division Number, Specification Number, Sequential Item Number, Sequential Submission Number.
 - 4. Submittal Numbering
 - a. Submittal Number; Division Number, Specification Number, Sequential Item Number, Sequential Submission Number.

- 1) Division Number: 06-1000.01.01
- 2) Specification Number: 06-1000.01.01
- 3) Sequential Item Number: 06-1000.01.01
- 4) Sequential Submission Number: 06-1000.01.01
5. Additional Submittal Information required:
 - a. Provide the following information with each submittal. Information can be included within the transmittal or can be provided on a separate submittal cover sheet. Where a separate submittal cover sheet is provided, include all the information required to be on the transmittal on the cover sheet along with the following:
 - 1) Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 2) Provide space for Contractor and Architect review stamps.
 - 3) Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a) Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - b. Identify by highlighting or other identification method, relevant product data including but not limited to, options, specific model information and other relevant information where various non-relevant information exists within the submitted materials. Submittal will be returned without action where relevant information is not identified.
 - c. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - d. When revised for resubmission, identify all changes made since previous submission.
6. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
7. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 - a. Submittals not requested will not be recognized or processed.
8. Submittals not requested will be recognized, and will be returned "Not Reviewed".
9. Resubmittals: Make revisions as necessary to comply with the requirements of the Contract Documents and the comments of the previous submittal review. Format the resubmittal as required for the initial submittal and provide all information. Number resubmittal sequentially by modifying the last 2 digits of the submittal number to the next highest number.
 - a. If a submittal is resubmitted without modification from the original submittal or without the requested information or compliance with the review comments of the previous submittal, the submittal will be returned without action. Where more than two (2) non-compliant resubmittals are received and returned without action due to non-compliance with the Contract Documents, or the comments of the previously submitted and returned submittals, the Contractor shall be required to compensate the Owner for additional services for multiple reviews of non-compliant submittals.
10. Retain copies of submittals on site, that have completed the submittal review process. Utilize only final action submittals that are marked with approving actions indicated within the the Architect's Submittal Review and Transmittal Form.

B. Submittal Processing Time

1. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 - b. Send submittal in electronic format via email to Architect.
 2. Where Work has been split between multiple subcontractors, suppliers, installers, the Prime/General Contractor shall be responsible for coordinating and combining the submission of submittals for systems and/or portions of systems such that the Architect can review each portion with its related components. The Architect shall notify the Prime/General Contractor if additional information or additional submittals are required and when the submittal(s) received was/were not properly coordinated or if it was received with insufficient information to complete a review. Submittal review time shall not start until a coordinated and complete submission of submittals is received by the Architect
 3. Submittals requiring selection of colors will not be fully reviewed until all related items requiring color selection are submitted respectively. Furthermore, no colors shall be selected until the Owner has selected a color scheme based upon the submitted samples of finishes.
 - a. For example: no exterior color selections shall be made until samples of all exposed materials on the exterior of the building have been submitted, color boards presented to the Owner and the Owner has selected/approved the finish selections presented on the color board(s).
 4. Schedule submittals to expedite the Project, and coordinate submission of related items. The following submittal processing times are estimated processing times. The Architect will attempt to provide submittal reviews within the time frame indicated however additional time may be necessary to review complex, large, or simultaneously provided submittal packages. The Architect will notify the Contractor if the Architect believes the submittal review will extend beyond the time frames indicated below. Submittal review time beyond the time frames indicated below will not be cause for extension to the Contract Time or the Contract Sum. It is the Contractor's responsibility to coordinate submittal submissions to allow for processing time.
 - a. For each submittal for review, allow 15 business days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendar days for each entity or consultant required to review the submittal.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 calendar days.
- C. Product Data Procedures:
1. Submit only information required by individual specification sections.
 - a. Mark each copy of each submittal to show which products and options are applicable.
 - b. Where more than one product or where a single product has different options for different applications, submit a separate product data package for each product or different configuration of a single product is required.
 - c. Include the following information, as applicable:
 - 1) Manufacturer's catalog cut sheets.
 - 2) Manufacturer's product specifications; modify or indicate appropriate information. Unmodified general specifications including information not applicable to the specified product shall not be acceptable.
 - 3) Standard or custom color charts or color chips/rings.
 - 4) Statement of compliance with specified reference standards.
 - 5) Testing by recognized testing agency.
 - 6) Application of testing agency labels and seals.

- 7) Notation of coordination requirements.
 - 8) Availability and delivery information.
 - d. For equipment, include the following in addition to the above, as applicable:
 - 1) Wiring diagrams showing factory installed wiring.
 - 2) Printed performance curves.
 - 3) Operational range diagrams.
 - 4) Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
 5. Submit sustainable design reporting submittals under separate cover.
 6. If information must be specially prepared for submittal because standard published data is not suitable for use, submit as a Shop Drawing, not as product data.
- D. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work. Digital data files may be procured from the design team (Architect and Architect's consultants) as a convenience to the contractor, are not guaranteed, and are only available for conditional use as stipulated by the "Release For Transmission of Digital Data".
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Digital data files including but not limited to CAD (.dwg) or Revit (.rvt) may be purchased from the design team (Architect or Architect's consultants) directly at a cost of One Hundred Dollars (\$100.00) per sheet or drawing. The following stipulations apply to the transmission of digital data files and shall be accepted by the purchaser as conditional use of the files.
 - a. Release For Transmission of Digital Data: The digital data furnished is solely for the exclusive and limited use of the purchaser receiving the data, and solely in direct connection with the Project. The data has been generated by Manns Woodward Studios, Inc. and/or the consultants of Manns Woodward Studios, Inc.; the details and design intent in the data is the intellectual property of the entity who generated the data. Use of this data in any way for any other project or application represents infringement of Manns Woodward Studios, Inc. copyright. The party (the purchaser) receiving the data shall, to the fullest extent permitted by law, indemnify and hold harmless Manns Woodward Studios, Inc, its consultants and the Project Owner from all claims, damages, losses, liability, and expenses, including attorney's fees arising out of or resulting from the use of the data. The recipient (purchaser) acknowledges that any use of this digital data represents full acceptance of and agreement with the terms of this release. Manns Woodward Studios, Inc. and its consultants make no warranty or guarantee, either assumed or implied, as to the accuracy of this data. The purchaser accepts that the use of the transmitted data is at the sole risk of the purchaser. The recipient (purchaser) of the digital data shall not transmit the digital data, or materials prepared from this digital data to other entities/parties without first obtaining acceptance in writing from the other entity/party a Release For Transmission of Digital Data including all the stipulations of this Release For Transmission of Digital Data.
 4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- E. Samples Procedures:
1. Transmit related items, accessories and integrated/related components, together as single package.

2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 - a. Attach label on unexposed side of samples. Include the following information on label:
 - 1) Product Name and name of manufacturer.
 - 2) Sample source.
 - 3) Number and title of Specification Section, Specification paragraph, and generic name of each item.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

F. Certification or Certificate Submittals:

1. Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer of other individual authorized to sign documents on behalf of that entity.

3.17 SUBMITTAL REVIEW

A. Contractor's Review

1. Contractor is required to review each submittal for general compliance with the Contract Documents. Any submittal received by the Architect that has not been reviewed by the Contractor, in the opinion of the Architect, that represents a blatant disregard of the Contractors responsibilities to review the submittal for compliance, shall be returned to the Contractor without action. Multiple submissions of a submittal representing a blatant disregard for the Contractors responsibility shall be cause for the Contractor to reimburse the Owner for the additional services of the Architect and the Architect's consultants. In addition, the Contractor may be liable for damages owed to the Owner for any project delays or other costs resulting from multiple reviews of non-compliant submittals.
2. Contractor shall provide and indication of review and approval on each submittal.
3. Contractor shall not provide Architect with any submittal until it has been reviewed and approved by the Contractor.

B. Architect's and Architect's Consultants Review

1. Architects review is only for the general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Corrections or comments made on the Submittal during this review fo not relieve the Contractor from complying with the requirements of the Contract Documents or any AHJ (Auhtority Having Jurisdiction). Review of a specific item shall not be deemed a review of the assembly of which the item is a component. The Contractor is resposible for (1) confirmation and correlation of all quantities and dimensions at the job site, (2) information that pertains solely to the fabrication preocesses or to the means, methods, techniques, sequences, and procedures of construction, (3) the coordination of work with all other trades (4) for performing all work in a safe and satisfactory manner, and (5) coordinating substrates and attachments to substrates/supporting materials.
2. Submittals for Review: Architect will review each submittal, make marks to indicate corrections or revisions required or identify additional information required for a complete review, or take other appropriate action.
3. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
4. Architect's actions will be reflected by completing and attaching a "Submittal Review and Transmittal" form for each returned submittal.

- a. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
5. Architect's actions on items submitted for review:
 - a. General: The "Action" indicated on the "Submittal Review and Transmittal" form identifies the appropriate deemed "Action" for the indicated Submittal. The "Action" indicated on the form is based upon a review of the Contractor's submittal but is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of the submittal is not conducted for the purpose of determining the accuracy and completeness of the other details such as dimensions and quantities, or for substantiating instructions for installation; All of which remains the responsibility of the Contractor. The Contractor shall not be relieved responsibility for deviating from requirements of the Contract Documents by the Architects "Approval" of submittals. The Contractor shall not be relieved of responsibility for errors or omissions in the Shop Drawings, Product Data, Samples, or similar submittals by the Architect's "Approval" thereof.
 - b. Architect's Actions Definitions
 - 1) **"Approved"**: Submittal conforms with information given and the design concept in the Contract Documents.
 - 2) **"Approved, Comments Noted"**: Submittal conforms with information given and the design concept expressed in the Contract Documents except as noted. Contractor shall coordinate and/or adjust submittal information/Contractor work plan to conform to the information given and the design concept expressed in the Contract Documents. DO NOT RESUBMIT unless noted otherwise.
 - a) Comments may include the statement to "revise and resubmit for record". Where the statement "revise and resubmit for record" is part of the comments, the Contractor shall resolve or incorporate the comments as may be applicable, shall proceed with the work dependent upon the submittal and also revise and resubmit the submittal for record purposes. Submittals received for record purposes will not be returned.
 - 3) **"Revise and Resubmit"**: Submittal does not conform with information given and/or the design concept expressed in the Contract Documents. Contractor shall coordinate and/or adjust submittal information/Contractors work plan to conform to the information given and the design concept expressed in the Contract Documents and resubmit the submittal.
 - 4) **"Rejected"**: The submittal is non-compliant. The Architect shall provide a reason for non-compliance. Contractor is responsible for providing a compliant submittal.
 - 5) **"Returned without Action"**: Submittal is defined within the Contract Documents as a submittal that does not get a review or response from the Architect. The Architect may provide comments to submittals returned without action.
6. Architect's and consultants' actions on items submitted for information:
 - a. "Returned without Action": Submittal is defined within the Contract Documents as a submittal that does not get a review or response from the Architect. The Architect may provide comments to submittals returned without action.

END OF SECTION 01 3000



410.344.1460
8098 Sandpiper Cir Suite H
Nottingham, MD 21236

SUBMITTAL REVIEW AND TRANSMITTAL

Project:		Owner:	
Project Name Address 1 Address 2 Address 3		Owner Representatives Name Owner Company Name Address 1 Address 2	
Contractor:		Architect:	
Contractor Representative Contracting Company Name Address 1 Address 2		Reviewer Name MW Studios 8098 Sandpiper Cir, Suite H Nottingham, MD 21236	Project Number: xx-xxx

SUBMITTAL Submittal Number - Name

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. The purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

ARCHITECTS ACTION

By: Reviewer Name

Date: 01/01/1234

The following indicated "ACTION" is the appropriate deemed "ACTION" for the above indicated "SUBMITTAL". The "ACTION" indicated below is based upon a review of the Contractors "SUBMITTAL" but is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of such "SUBMITTAL" is not conducted for the purpose of determining the accuracy and completeness of the other details such as dimensions and quantities, or for substantiating instructions for installation; All of which remains the responsibility of the Contractor. The Contractor shall not be relieved of responsibility for deviating from requirements of the Contract Documents by the Architects "Approval" of Shop Drawings. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar Submittals by the Architects "Approval" thereof.

☐	Approved	Submittal conforms with information given and the design concept expressed in the Contract Documents
☐	Approved, Comments Noted	Submittal conforms with information given and the design concept expressed in the Contract Documents EXCEPT AS NOTED. Contractor shall coordinate and/or adjust submittal information/Contractors work plan to conform to the information given and the design concept expressed in the Contract Documents. DO NOT RESUBMIT unless noted otherwise.
☐	Revise and Resubmit	Submittal does not conform with information given and the design concept expressed in the Contract Documents. Contractor shall coordinate and/or adjust submittal information/Contractors work plan to conform to the information given and the design concept expressed in the Contract Documents. RESUBMIT.
☐	Rejected	
☐	Returned without Action. See comments.	

01/01/1234

Submittal Number - Name

COMMENTS:

1. See ARCHITECTS ACTIONS

2. Contractor shall coordinate submittal information and schedule of the Work with all trades.

3. Dimensional and quantity mark-ups are intended to convey conformance with design concept expressed in the Contract Documents. Contractor remains responsible for given information provided within the Contract Documents and the coordination of all quantities and dimensions with the Work and the existing conditions.

ADDITIONAL COMMENTS:

4.

SECTION 01 3216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, with network analysis diagrams and reports.

1.2 RELATED SECTIONS

- A. Section 01 1000 - Summary: Work sequence, occupancy, and owner-furnished items.
- B. Section 01 3000 - Administrative Requirements: For submitting schedules and reports.

1.3 DEFINITIONS

- A. Activity: A discrete part Project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical Path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either the Owner or the Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
 - 4. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

- A. Within 14 calendar days after date of Agreement, submit preliminary schedule defining planned operations for the first 30 days of Work, with a general outline for remainder of Work.
 - 1. Provide list of major subcontractors (any subcontractor assigned more than 5% of the Work based on to provide work throughout the duration of the project).
 - 2. Provide list of long lead t
 - 3. Provide Submittal Schedule; See Section 01 3000 - Administrative Requirements.
- B. If preliminary schedule requires revision after review, submit revised schedule within 7 calendar days.
- C. Within 30 calendar days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Submit updated schedule with each Application for Payment.
- E. Submit schedules in PDF format.
- F. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- G. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.

1.5 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with five (5) years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of major subcontractors, submittal schedule, progress reports, payment requests, and other required schedules.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinante each construction activity in the network with other activities and schedule them in proper sequence.

1.7 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

- B. Diagram Sheet Size: Maximum 22 x 17 inches.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.2 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
 - 1. Include, within schedule, constraints and work restrictions indicated in the Contract Documents and as follows. Show how the sequence of the Work is affected.
 - a. Work Restrictions:
 - 1) Coordination with existing construction.
 - 2) Coordination with Occupants.
 - 3) Use of site and premises restrictions.
 - 4) Environmental controls.
 - b. Construction Areas: Identify each major areas of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - 1) Structural Completion
 - 2) Temporary enclosure and space conditioning
 - 3) Permanent space enclosure
 - 4) Completion fo mechanical installation
 - 5) Completion of electrical installation.
 - 6) Substantial Completion.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules for each stage of Work identified in Section 01 1000 - Summary and as follows:
 - 1. Submittals
 - 2. Fabrication
 - 3. Delivery
 - 4. Mockups
 - 5. Installation
 - 6. Testing and Inspections
 - 7. Adjusting

- 8. Curing
- 9. Startup and placement into final use and operation.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Include implementation and termination dates for temporary facilities and utilities.
- H. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- I. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- J. Indicate delivery dates for owner-furnished products.
- K. Coordinate content with schedule of values specified in Section 01 2000 - Price and Payment Procedures.
- L. Provide legend for symbols and abbreviations used.

3.3 NETWORK ANALYSIS

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 - 1. Preceding and following event numbers.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15 day intervals.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.
 - 8. Latest start date.
 - 9. Latest finish date.
 - 10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
 - 11. Monetary value of activity, keyed to Schedule of Values.
 - 12. Percentage of activity completed.
 - 13. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:

1. By preceding work item or event number from lowest to highest.
2. By amount of float, then in order of early start.
3. By responsibility in order of earliest possible start date.
4. In order of latest allowable start dates.
5. In order of latest allowable finish dates.
6. Contractor's periodic payment request sorted by Schedule of Values listings.
7. Listing of basic input data that generates the report.
8. Listing of activities on the critical path.

- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information
 3. Rejected or un-retained submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.

3.4 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 7 calendar days.

3.5 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.6 DISTRIBUTION OF SCHEDULE

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

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

END OF SECTION 01 3216

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.
- K. Defect Assessment.

1.2 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 4216 - Definitions.
- D. Section 01 4219 - Reference Standards.
- E. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.3 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. Mock-ups: Full size physical assemblies that are constructed on-site. Mock-ups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mock-ups are not Samples and Samples are not Mock-ups. Unless otherwise indicated, approved mock-ups establish the standard by which the Work will be judged.
- C. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- D. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related (Delegated Design): Design services (Delegated Design) explicitly required to be performed by another design professional for a specific, specialized, or highly technical portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design. Design services (Delegated Design) requires services to be performed by an engineer licensed within the state and/or jurisdiction in which the project is located unless otherwise noted.
- E. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.4 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary pedestrian protection structures, walkways, and barriers, or other similar protective measures.
 - 4. Temporary bracing.
 - 5. Temporary falsework for support of spanning or arched structures.
 - 6. Temporary foundation underpinning.
 - 7. Temporary stairs or steps required for construction access only.
 - 8. Temporary hoist(s) and rigging.
 - 9. Investigation of soil conditions to support construction equipment.

1.5 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 - 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Contractor's Quality Control (CQC) Plan: For quality-assurance and quality-control activities and responsibilities.
- C. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- D. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- E. Test and Inspection Reports: After each test/inspection, promptly submit signed copies of report to Architect, Owner, and Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name and of personnel conducting test and/or inspection.
 - d. Date, time, and site conditions at time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location of test and/or inspection within the Project.
 - g. Type of test/inspection and description of test and/or inspection method.
 - h. Date of test/inspection.
 - i. Results of test/inspection including all data collected.

- j. Statement indicating compliance of results with Contract Documents. Include recommendations for retesting and reinspecting.
 - k. Provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- F. Test and Inspection Log
 - 1. Prepare a record of tests and inspections. Include the following:
 - a. Date the test or inspection was performed.
 - b. Description of the Work tested or inspected.
 - c. Date test or inspection report was transmitted to Architect.
 - d. Identification of testing agency or special inspector conducting the test or inspection.
 - e. Compliance or non-compliance with requirements.
 - f. Whether or not corrective action was taken or recommended.
 - 2. Post changes and revisions to the log as they occur. Provide access to Architect and Owner for reference and information.
- G. 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 complies with 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.
- H. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing for information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- I. Manufacturer's Field Reports: Submit report documenting manufacturer's technical representatives observations, testing results, and inspection results.
 - 1. Submit report within 7 calendar days of performance of observations, testing, and inspection to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
 - 3. Include within the report the following information:
 - a. Name and signature of technical representative who performed observations, tests, inspections and making report.
 - b. Statement indicating suitability of conditions of substrates and surfaces.
 - c. Statement that products/equipment at Project site comply with requirements of Contract Documents.
 - d. Summary of installation procedures being followed/performed, 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 indicating whether conditions, products, and installation will affect warranty.

g. Other items indicated within 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 compliance with information given and the design concept expressed in the Contract Documents.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Contractor's Quality Control (CQC) Plan:
1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.

- d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
 - D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.
 - 1. Quality control personnel managing the CQC shall have prior experience performing similar duties within the jurisdiction that the Work is being performed. Additionally, the manager of the plan shall have successfully completed the management of a CQC for a project with similar scope and work tasks as the Project.
 - E. Highest Quantity and/or Highest Quality: Should the Contract Documents establish different or conflicting requirements for minimum quantities or quality levels, the Contractor shall include within the Contract Sum and account for in the Contract Time the furnishing and installation of the most stringent requirement, the higher quantity, and the higher quality. The Contractor shall submit a Request for Information to clarify the differing or conflicting requirements prior to initiating the Work of the differing or conflicting requirements
- 1.8 REFERENCES AND STANDARDS - SEE SECTION 01 4219
- 1.9 TESTING AND INSPECTION AGENCIES AND SERVICES
- A. Contractor will employ the services of an independent testing agency to perform testing and inspections as specified within the Contract Documents and may be required by any Authority Having Jurisdiction over the Project.
 - 1. Payment for cost of services will be derived from allowance specified in Section 01 2100 - Allowances; See Section 01 2100 and applicable sections for description of services included in allowance.
 - B. As indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform specified testing and inspections.
 - C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
 - D. Contractor Employed Agency:
 - 1. Testing/Inspection agency: An NRTL, and NVLAP, or an independent agency with experience and capability to conduct testing and/or inspecting services indicated, as documented according to and complying with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740 as may be applicable; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction; and that is acceptable to authorities having jurisdiction.
 - a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 - 2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.

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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 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.

3.2 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings or within Specifications. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.
- E. Notify Architect and Owner seven (7) calendar days in advance of dates and times when mock-ups will be constructed.

- F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within seven (7) calendar days of initial review and each subsequent follow up review of each mock-up.
 - 2. Make corrections as necessary until Architect's approval is issued.
- J. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- L. Where possible salvage and recycle the demolished mock-up materials.

3.3 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.

3.4 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preinstallation meetings and upon request of the Architect attend progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to attend preinstallation meetings, observe, inspect, and test site conditions, conditions of surfaces and installation of substrates, installation of products, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to report unsatisfactory conditions, and to initiate instructions for repairs when necessary.
- B. Submit qualifications of manufacturer's technical representative to Architect 30 days in advance of required observations/services.
 1. Manufacturer's technical representative subject to approval of Architect and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect and Owner, it is not practical to remove and replace the work, Architect and Owner will direct an appropriate remedy or adjust payment.

3.7 REPAIR AND PROTECTION

- A. Contractor shall, on completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with Contract Document requirements for cutting and patching in Section 01 7000 - Execution and Closeout Requirements.
- B. Protect existing adjacent surfaces to remain from damage or deterioration due to testing and inspection procedures or repair required by or as a result of testing and inspection procedures.

END OF SECTION 01 4000

SECTION 01 4216 - DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

1.2 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4216

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SECTION 01 4219 - REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements relating to referenced standards.

1.2 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with the reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.
- E. Should reference and compliance with two or more standards specified in the Contract Documents establish different or conflicting requirements for minimum quantities or quality levels, the Contractor shall include within the Contract Sum and account for in the Contract Time the furnishing and installation of the most stringent requirement, the higher quantity, and the higher quality. The Contractor shall submit a Request for Information to clarify the differing or conflicting requirements prior to initiating the Work of the differing or conflicting requirements.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

END OF SECTION 01 4219

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SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices and temporary facilities.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary; For work restrictions and limitations on utility interruptions.
- B. Section 01 5213 - Field Offices and Sheds.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- D. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SUBMITTALS FOR INFORMATION

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, lay-down and storage areas, construction site entrances, vehicle circulation, and parking areas for construction personnel (where allowed).

- B. Implementation and Termination Schedule: Within 15 calendar days of date established for commencement of the Work, submit schedule indicating implementation dates of each temporary utility.

1.5 TEMPORARY UTILITIES

- A. Installation and removal of temporary utilities shall be included within the Contract Sum unless otherwise indicated. Allow other entities engaged in Project to use temporary utilities without cost, including but not limited to, Owner's construction forces, Architect, occupants of Project, testing and inspection personnel, and authorities having jurisdiction.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility prior to use. Obtain required certifications and permits.
- C. Conservation
 - 1. Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste of resources and associated fees/costs.
- D. Location: Locate utility service and access/use points where they will serve Project adequately and result in minimum interference and maximum efficiency for/with performance of the Work. Relocate and modify facilities as required by/for progress of the Work.
- E. Provide each temporary utility ready for use when needed to avoid delay. Do not remove temporary utilities until they are no longer required for construction operations or until permanent utilities are approved for temporary use for construction operations.
- F. Contractor shall coordinate with utility company, Owner, Using Agency, and occupants for service interruptions and shut downs required for temporary service connections/disconnections. See Section 01 1000 - Summary.
- G. Temporary Electricity
 - 1. Connect to Owner's existing power service. Provide connections and extensions of service as required for construction operations and temporary facilities.
 - a. Owner shall pay for use charges of existing electrical service including temporary service for construction operations.
 - b. Do not disrupt Owner's need for continuous service.
 - 2. Provide temporary electric service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 3. Comply with NECA, NEMA, and UL standards and regulations for temporary electrical service and extensions of existing services for temporary purposes. Install service to comply with NFPA 70.
- H. Temporary Water
 - 1. Connect to Owner's existing water service. Provide connections and extensions of service as required for construction operations and temporary facilities.
 - a. Owner shall pay for use charges of existing service including temporary service for construction operations.
 - b. Do not disrupt Owner's need for continuous service.
 - 2. Provide temporary water service and distribution system of sufficient size, capacity, and pressure characteristics required for construction operations.

- a. Use trigger operated nozzles for water hoses, to avoid waste of water.

- I. Sewers and Drainage

- 1. Provide temporary utilities to remove effluent lawfully.
 - a. Connect new temporary sewers to municipal system as directed by authorities having jurisdiction
 - b. Owner shall pay use charges of sewer service for sewer usage by all entities for construction operations and temporary facilities.

1.6 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

1.7 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to contractors field office(s), Owners field office(s), and Architects field office(s) at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Internet Connections: Provide secure WiFi wireless connection to internet with; Contractor, Owner, and Architect

1.8 TEMPORARY SANITARY FACILITIES

- A. Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type number, location, operation, and maintenance of fixtures and facilities.
- B. Use of permanent toilet facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.9 TEMPORARY HEATING, VENTILATION, AND COOLING

- A. Provide temporary heating and cooling as required by construction operations for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperature or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- B. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying. Maintain dehumidification systems where installed Work requires controlled humidity levels until such time that permanent systems are installed and maintaining required humidity levels.

- C. Provide temporary ventilation equipment to maintain clean air for construction operations, and as required within individual Specification Sections.
- D. Equipment:
 - 1. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide with MERV 8 filter at each return air grille in system and remove at end of construction and clean HVAC system as required in Section 01 7000 - Execution and Closeout Requirements.
 - 2. Unless Owner authorizes use of permanent HVAC systems, provide vented self contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - a. Use of gasoline burning space heaters, open flames heaters, or salamander-type heating units is prohibited.
 - 3. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

1.10 SECURITY AND PROTECTION

- A. Barriers
 - 1. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
 - 2. Provide structurally adequate barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building. Design and engineering of barricades shall be responsibility of the Contractor. Provide warning signs and lighting.
- B. Provide protection for plants designated to remain. Replace damaged plants.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- D. Traffic Controls
 - 1. Provide traffic controls for construction operations as required by and in compliance with Authority Having Jurisdiction.
 - 2. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
 - 3. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and guide traffic.
 - 4. At approaches to site and on site, install traffic signs and signals at crossroads, detours, parking areas, and elsewhere as required to direct construction and affected public traffic and as required by AHJ.
- E. Temporary Fire Protection: Install and maintain temporary fire protection facilities of types to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections..
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of AHJ

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Fire Extinguishers: Provide portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposure.
- F. Pest Control: Engage pest-control service to recommend practice to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

1.11 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.12 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings to separate work areas from Owner-occupied areas, to prevent penetration of dust, fumes, odors, and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
1. Framing: Minimum 3-5/8 inch metal studs; size metal studs per span tables of metal stud manufacturer.
 2. Insulated; fill stud cavity with mineral wool insulation.
 3. Minimum STC rating of 35 in accordance with ASTM E90.
 4. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to tested assembly requirements.
- D. Where access is required to be installed within the temporary partition, construct a vestibule airlock with not less than 48 inches between doors.
1. Provide walk-off sticky mats at each entrance through temporary partition.
 2. Provide gasketed dustproof doors and security locks.
- E. Prior to commencing work, isolate the HVAC system in the area bound by the temporary partition and other existing work area boundary assemblies by disconnecting supply and return ductwork serving the work area.
1. Seal openings in ductwork where ductwork continues to serve occupied areas.
- F. Maintain negative air pressure within work area, using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

1.13 VEHICULAR ACCESS AND PARKING

- A. Access Roads
 - 1. Minimize, to the greatest extent possible, use of existing on-site streets and driveways for construction traffic. Coordinate access to construction entrance.
 - 2. Tracked vehicles and equipment are prohibited on paved areas.
- B. Parking
 - 1. Construction personnel are prohibited from utilizing existing on site parking facilities. Construction personnel shall be required to find and utilize off-site legal parking.
- C. Existing pavements, parking areas, and other improvements.
 - 1. Where portions of existing site, including but not limited to, on-site roads, driveways, or other paved areas are utilized for construction access, construction operations, parking, installation of temporary facilities, or other construction related activities, the Contractor shall be responsible for replacing or repairing existing improvements. Repairs or replacement construction shall be consistent with newly installed construction of assembly or items matching existing assemblies or items.
- D. Maintenance.
 - 1. Maintain traffic and parking areas in sound condition free of excavated materials, construction equipment, products, trash/debris, gravel/stone, mud, snow, and ice.
 - 2. Maintain paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
- E. Removal, repair.
 - 1. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Repair and complete the Work of the Project.
 - a. Where areas are intended for landscape development, remove soil and aggregate fill that does not comply with Contract Document requirements for fill, base, sub-base, and/or soil of landscaped areas. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, as well as other substances that might impair growth of plant materials or lawns.
 - b. Repair or replace paving, curbs, sidewalks, and/or other permanent/existing to remain construction affected by the installation or use of temporary roads or paved areas for construction operations.
- F. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- G. Coordinate access and haul routes with governing authorities and Owner.
- H. Provide and/or maintain access to fire hydrants and control valves, free of obstructions.
- I. Provide means of removing mud and debris from vehicles and wheels before entering streets.

1.14 WASTE REMOVAL

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.15 PROJECT SIGNS

- A. Project Identification
 - 1. Provide one project identification sign of design, content, and construction as required by Owner.
 - 2. Erect on site at at location(s) designated by Architect.
 - 3. No other signs are allowed without Owner permission except those required by law.
- B. Project Information and Direction
 - 1. Signs shall be standard products or custom signs capable of withstanding environmental conditions, including but not limited to, weathering, sun exposure, and wind exposure. Lettering and directional graphics shall be visible and legible at 100 foot distance.
 - 2. Provide information signs at each field office.
 - 3. Provide directional signs to direct traffic to project entrance and to direct traffic within Project site.
 - 4. Provide municipal traffic agency directional traffic signs as required by Authority Having Jurisdiction.
 - 5. Maintain signs to be visible and legible at all times. Replace signs that are missing or become damaged and illegible.
 - 6. Provide signs directing occupants to temporary egress locations/exits. Signs shall be as required by Authority Having Jurisdiction.

1.16 FIELD OFFICES AND TEMPORARY FACILITIES - SEE SECTION 01 5213

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

SECTION 01 5213 - FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary field offices for use by entities involved with the project; Common Use Field Office.
- B. Temporary field offices for use of Contractor.
- C. Temporary facilities for Owner/Using Agency operations.
 - 1. Temporary Sleeping Facility
 - 2. Temporary Administrative and Day-use/Lounge Facility.
 - 3. Temporary Toilet and Shower Facility.
- D. Maintenance and removal.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: use of premises and responsibility for providing field offices.
- B. Section 01 5000 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.
- C. Section 01 5000: Parking and access to field offices.
- D. Section 01 5500: Parking and access to field offices.

1.3 USE OF EXISTING FACILITIES

- A. Existing facilities shall not be used.

1.4 USE OF PERMANENT FACILITIES

- A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.1 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.2 CONSTRUCTION

- A. Portable or mobile buildings, securely fixed to foundations, with steps and landings at entrance doors.

1. Where required by authorities having jurisdiction, provide accessible access to temporary facilities, including but not limited to, ramps, guard rails, handrails, and landings.
 - a. Configuration of access deck/landing and associated components shall be as indicated within the drawings.

- B. Construction: Structurally sound, secure, weather tight enclosures. Maintain during progress of Work; remove prior to Substantial Completion, as directed by Owner or Architect, or after field offices are transitioned to location within permanent facilities; Obtain Owner's permission in writing prior to moving offices.
- C. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.
- D. Fire Extinguishers: Appropriate type fire extinguisher at each office.
- E. Permitting: Contractor shall be responsible for obtaining permits for temporary facilities. This Work shall include the production of and provision for any/all documents required.

2.3 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain 68 degrees F heating and 76 degrees F cooling.

2.4 COMMON USE FIELD OFFICE

- A. The Common Use Field Office may be combined with Contactor's Office and other administrative offices in a single portable or mobile unit; Each work space and meeting space must be separated by partitions and be equipped with doors. Contractor's Office and Administrative Office(s) shall comply with requirements as indicated within each following Article respectively.
- B. Furnishings in Meeting Area: Conference table and chairs to seat at least ten persons; racks and files for Contract Documents, submittals, and project record documents
- C. Drinking Water dispenser and disposable cups.

2.5 CONTRACTOR OFFICE AND FACILITIES

- A. Size: For Contractor's needs.
- B. Other Furnishings: Contractor's option.
- C. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer .

2.6 OWNER/USING AGENCY SLEEPING, ADMINISTRATIVE, DAY-USE/LOUNGE, TOILET, AND SHOWER

- A. Utilities

1. Contractor shall coordinate and install water, sewer, electrical, and fire protection (fire protection services shall comply with all AHJ requirements) to each temporary facility. Services to temporary facilities shall be maintained for the duration of construction or until such time the Owner occupies the building or portion of the building providing the function of the temporary facility(ies). Upon Owner occupancy of the building or portions thereof, sufficient to serve the same purpose/function as the temporary facility(ies), the Contractor shall remove the temporary facility(ies) along with all associated services, patch and repair existing construction to remain, and/or otherwise finish/complete the Work as indicated within the Contract Documents.
- B. Windows: Provide at least one within each separate space, with minimum total area equivalent to 10 percent of floor area of that space, with an operable sash and insect screen.
- C. Owner Occupancy Coordination and Scheduling: Owner use temporary facilities must be installed, functional for intended usage, able to be occupied, and furnished prior to Owner vacating the existing building.
 1. Owners continued and uninterrupted occupancy and operation must be maintained.
 2. Coordinate with Owner for Owner provided furnishings.
 3. Include within Construction schedule time for set-up, furnishing, and moving operations of temporary facilities and Owner personnel and equipment.
- D. Temporary Sleeping Facility
 1. Separate portable or mobile unit for sole use by Owner/Using Agency.
 - a. Each sleeping area shall be accessible directly from the exterior or from a shared vestibule. The vestibule shall be a minimum of 5 feet in width; provide a 54 inch clear space in front of each door parallel with the door opening; and have a minimum distance between doors in series of 4 feet.
 2. Sleeping area(s) shall be provided in number indicated and sized to accommodate the following:
 - a. One sleeping area accommodating 11 XL Twin single bed frame(s).
 - b. Owner shall be responsible for providing furniture.
 3. Each separate sleeping area shall be provided with an escape window complying with the local building code enforceable at the time the temporary facilities are permitted. The escape window shall not be obstructed by furniture.
- E. Temporary Administrative and Day-use/Lounge Facility
 1. Separate portable or mobile unit(s) for sole use by Owner/Using Agency.
 2. Owner shall be responsible for providing and installing furniture and equipment, including residential appliances, within Owner use temporary facilities.
 3. Unit(s) shall be provided with the following:
 - a. Office(s): Provide Two (2) enclosed lockable office(s); Minimum 80 square feet each with minimum dimension of 8 feet in any direction.
 - b. Kitchenette consisting of the following minimum requirements:
 - 1) Stainless steel kitchen sink and kitchen faucet; minimum single bowl sink, extra deep, min. 20 x 24 inches.
 - 2) Clear/Open counter space of at least 36 inches. Additional counter space may be required to accommodate equipment.
 - 3) Equipment:
 - a) Multiple (2) Microwave; 30 inch wide counter mounted.

- b) Multiple (2) Refrigerator/Freezer; Standard 36 inch wide full size refrigerator with ice maker. Contractor shall provide water line to refrigerator.
 - c) Dishwasher; Standard 2 rack 24 inch wide dishwasher.
 - 4) Base and wall cabinets; standard height; base cabinets with drawers and doors; walls cabinets with doors.
 - a) Extent of wall cabinets shall match base cabinets.
 - c. Day-use/Lounge: Provide open area sized and appointed to accommodate the following:
 - 1) Furniture/Equipment
 - a) Lounge Chairs/Recliners: 9 units.
- F. Temporary Toilet and Shower Facility
 - 1. Separate portable or mobile unit for sole use by Owner/Using Agency.
 - 2. Provide 4 separate bath rooms consisting of water closet, lavatory, and shower.
 - a. Two bath rooms shall be ADA accessible.
 - 3. Provide mechanical ventilation in each bathroom.
 - 4. Bathrooms shall not be provided with windows.

2.7 STORAGE AND FABRICATION SHEDS

- A. Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
- B. Storage of combustible materials shall be separated from the building by a minimum of 30 feet.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.
- B. Employee Residential Occupancy: Not allowed on Owner's property.

3.3 MAINTENANCE AND CLEANING

- A. Maintain facilities in good operating condition until removal.
- B. Weekly janitorial services for offices; periodic cleaning and maintenance for offices. Owner shall provide janitorial services for Owner/Using Agency temporary facilities.
- C. Maintain approach walks free of mud, water, and snow.

3.4 TERMINATION AND REMOVAL

- A. Remove each temporary facility and associated foundations, utility services, and debris, when need for its service has ended, when it has been replaced by authorized use of permanent facilities, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been affected by and/or delayed because of interference with a temporary facility. Repair damaged Work or construction to remain, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
- B. Materials and facilities that constitute temporary facilities are the property of the Contractor.
- C. Prior to Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7000 - Execution and Closeout Requirements.

END OF SECTION 01 5213

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SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Identification of Owner-supplied products.
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.
- D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.3 REFERENCE STANDARDS

- A. NEMA MG 00001 - Motors and Generators.
- B. NFPA 70 - National Electrical Code.

1.4 DEFINITIONS

- A. Products: Items for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material", "equipment", "system", and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make and/or model number/name or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.

2. **New Products:** Items that have not previously been purchased for or incorporated into another project or facility and purchased from a product supplier, distributor, or manufacturer specifically for this Project. Products salvaged or recycled from other projects are not considered new products.
3. **Comparable Product:** Product that is demonstrated by manufacturers literature, product data, and testing results/reports/certifications to meet or exceed the minimum characteristics of Named Products and/or listed minimum requirements of the Contract Documents. Minimum Characteristics of products include but are not limited to, function, dimensions, in-service performance, physical properties, appearance, options (including color selection), and usability. The Owner and Architect have final determination whether or not a product meets or exceeds the minimum characteristics of the Named Product(s) and/or listed minimum requirements of the Contract Documents.
4. **Basis of Design Product:** Singular Named Product that establishes the significant minimum requirements of a product. Minimum requirements of a Basis of Design Product may be supplemented with additional requirements listed within the Contract Documents. Basis of Design Products are not intended to limit procurement of products to the Named Product unless noted within the product specification with "No Substitutions Allowed" or verbiage of similar intent. Comparable Products submitted for compliance with the product specification indicating a Basis of Design Product shall be reviewed against the characteristics of the Basis of Design Product and supplemental requirements listed within the specification. Basis of Design Products may also be products in which the specific characteristics of the Named Product were utilized in the design and engineering of the Project. Selection of Comparable Products in these cases may require Delegated Design Services or redesign at the expense of the Contractor.

1.5 SUBMITTALS

- A. **Product Data Submittals:** Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. **Shop Drawing Submittals:** Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances. Show coordination with adjacent products, accessories, and other construction. See Section 01 3000 - Administrative Requirements.
- C. **Sample Submittals:** Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.6 QUALITY ASSURANCE

1.7 PRODUCT WARRANTIES

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

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project specific information and properly executed.
 2. Specified Form: When specified forms are included with, appended to, or reference by the individual Specification Sections, prepare the written document using the indicated/provided form properly completed and executed.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. When individual Specification Sections indicate a Named Product or a list of Named Products, Contractor shall provide the Named Product or one of the Named Products unless specification section Article indicates other Comparable Products may be provided. Other Comparable Products shall be required to meet the minimum requirements and characteristics of the Named Product(s) along with any other listed requirements within the individual specification section.
 1. Where individual specification sections allow Comparable Products and those Comparable Products meet the minimum requirements of the Named Product and other requirements of the Section, the Contractor will not be required to comply with the Substitution Procedures of Section 01 2500 - Substitution Procedures. If the product does not meet all of the minimum requirements it shall be considered a substitution and the Contractor will be required to follow the Substitution Procedures of Section 01 2500 - Substitution Procedures.
 2. Where the phrase "No Substitutions Allowed" or "Provide one of the following" or verbiage of similar intent is indicated, the Contractor shall provide the Named Product or one of the Named Products only.
- B. Where individual Specification Sections provide performance requirements, specific requirements, specific characteristics, or other requirements without providing manufacturer's names or Named Products, Contractor shall provide products complying with or outperforming the requirements indicated. Products not meeting all the requirements listed shall be required to comply with the substitution procedures of Section 01 2500 - Substitution Procedures.

2.2 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

- D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
 - 1. See Section 01 1000 for list of items required to be salvaged for reuse and relocation.
 - 2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.3 NEW PRODUCTS

- A. Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, fasteners, finish, and other items needed for a complete installation and intended use and effect.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
 - 4. Containing lead, cadmium, or asbestos.
- D. Provide interchangeable components by the same manufacture for components being replaced.

2.4 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 1000 - Summary for identification of Owner-supplied products.

3.3 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas and other Project structures.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Do not store products directly on the ground.
- K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- M. Prevent contact with material that may cause corrosion, discoloration, or staining.
- N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

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

END OF SECTION 01 6000

SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including requirements for selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
- F. Section 01 7123 - Field Engineering: Additional requirements for field engineering and surveying work.
- G. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- H. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

- I. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- J. Section 02 4100 - Demolition: Demolition of whole structures and/or selective demolition of parts thereof; site utility demolition.
- K. Section 07 8413 - PENETRATION FIRESTOPPING.
- L. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.
 - 2. Limitations on cutting structural members.

1.3 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of five years of documented experience.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.6 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
 3. Provide dust control treatment in areas of bare soil that is non-polluting and non-tracking. Re-apply treatment as required to minimize dust to greatest extent possible.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
1. See 01 1000 - Summary for restrictions on excessively noisy operations.
- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent rodents, pests and insects from damaging the Work and accessing and invading premises.
1. Pest Control Service: Provide treatments as recommended by pest control company to maintain a pest free work area.
- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7 COORDINATION

- A. See Section 01 1000 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- I. Cutting and Patching Conference: Prior to proceeding with cutting and patching operations, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades, and original installer where possible. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
 - 1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, provide a match acceptable to Architect for the visual and functional performance of in-place materials.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions, Utilities
 - 1. Existence and location of underground and other utilities indicated within drawings is not guaranteed.
 - 2. Prior to beginning site work, investigate and verify the existence and location of underground utilities (underground or otherwise), mechanical and electrical systems, and other construction affecting the Work.
 - a. Verify the location and invert elevations at points of connection of sanitary sewer, and water-service piping; underground electrical services, and other utilities.
 - b. Furnish location data work related to Project that must be performed by public utilities serving Project site.
 - 3. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- B. Existing Conditions
 - 1. Prior to proceeding with each component of the Work, examine areas, substrates, surfaces, supporting structure(s), and other conditions that may affect the installation of the next components, products and/or assemblies. Examine with Installer(s) and Applicator(s) present of both installed Work and Work to be installed, for compliance with requirements for installation, including but not limited to, tolerances and surface preparation and adequacy.
 - 2. Examine and verify specific conditions described in individual specification sections.
 - 3. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication
 - 4. Examine rough-in for mechanical plumbing and electrical .
 - 5. Record observations, comments, acceptance or non-compliance, and corrective actions to be taken where necessary.
 - 6. Proceed with installation only after unsatisfactory conditions have been corrected.

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

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility components or systems in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
- C. Clean substrate surfaces prior to applying next material or substance.
- D. Seal cracks or openings of substrate prior to applying next material or substance.
- E. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS; SEE 01 3000 - ADMINISTRATIVE REQUIREMENTS

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

3.4 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 2. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 3. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- C. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- D. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- F. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- G. Make neat transitions between different surfaces, maintaining texture and appearance.

- H. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- I. Conduct construction operations so no part of Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- J. Sequence the Work and allow adequate clearance to accommodate movement of construction items on site and placement in
- K. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- L. Templates: Obtain and distribute to the parties involved, templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work and Coordination Drawings to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- M. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and align with other portions of the Work. Where size and type of attachment is not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installation anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete and masonry. Deliver such items to Project site in time for installation.
- N. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

3.5 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
 - 2. Provide sound retardant partitions of construction indicated within Contract Documents and in locations indicated w Contract Document.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and Alerting/Emergency Communications and Notification Systems): Remove, relocate, and extend existing systems to accommodate temporary and new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 1000 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protection
 - 1. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from damage/harm resulting from alteration work.
 - a. Use only proven protection methods, appropriate to each area and surface being protected.
 - b. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 - c. Erect temporary barriers to form and maintain emergency egress routes.
 - d. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 - e. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent areas or surfaces.
 - f. Provide shoring, bracing, and supports as necessary. Do not overload structural or supporting elements.
 - g. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
 - h. Provide supplemental sound-control treatment to isolate demolition work from o areas of the building.
- G. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- H. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- I. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- J. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- K. Clean existing systems and equipment.
- L. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- M. Do not begin new construction in alterations areas before demolition is complete.
- N. Comply with all other applicable requirements of this section.

3.6 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting and/or patching.
- B. See Alterations article above for additional requirements.
- C. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and restore surfaces without delay. Restoration of surfaces shall include, but is not limited to, preparing the surface to receive new Work and restoring the surface to match original condition/match adjacent surfaces.
- D. Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 2. Operational Elements: Do not cut and patch operational elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decrease operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the buildings' aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 5. Temporary Support: Provide temporary support of work to be cut and patched.
 - a. Shoring, bracing, and support elements and procedures are the responsibility of the contractor, including but not limited to design, installation, maintenance, safety, removal, and corrective actions to repair attachment/contact points with the Work.
- E. Perform minimum amount possible of cutting and patching as necessary to:
1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- F. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- G. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- H. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods, with materials, and in a manner acceptable to warranting entity to maintain the existing warranty of the products and assemblies effected by the cutting and patching operations.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, or other similar operation, using methods least likely to damage elements retained or adjoining construction.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimize size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut drill from exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as abrasive saw or a diamond core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting. See applicable other Sections that may contain additional or more stringent requirements.
- J. Restore work with new products in accordance with requirements of Contract Documents.

- K. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- L. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- M. Patching:
 - 1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and perform the Work to comply with installation requirements of other Sections for both the patching materials as well as the any materials to be installed onto patching materials.
 - a. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation and compliance with other Work.
 - 2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 3. Match color, texture, and appearance.
 - 4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.7 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to requirements of AHJ.
- E. Installed Work:
 - 1. Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials or methods are not recommended, use cleaning materials that are not hazardous to health property and that will not damage exposed surfaces.
 - 2. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3.8 PROTECTION OF INSTALLED WORK

- A. See Section 01 7610 for temporary protective covering materials.

- B. Limit Exposures: Supervise construction operations to assure that no part of the construction, complete or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- C. Protect installed work from damage by construction operations.
- D. Provide special protection where specified in individual specification sections.
- E. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- F. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- G. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- H. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- I. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- J. Prohibit traffic from landscaped areas.
- K. Prohibit hydraulic equipment from accessing areas with finished surfaces or surfaces that are to receive a clear, transparent, or translucent coating/covering. Where hydraulic equipment is needed to access areas with such surfaces, protect surfaces from spilled hydraulic fluid. Surfaces stained by hydraulic fluid will be removed and replaced in their entirety to provide consistent finish.
- L. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.9 SYSTEM STARTUP

- A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Notify Architect and Owner seven days prior to start-up of each item.
- D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- F. Verify that wiring and support components for equipment are complete and tested.
- G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

- I. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- 3.10 DEMONSTRATION AND INSTRUCTION; SEE 01 7900 - DEMONSTRATION AND TRAINING
- 3.11 ADJUSTING
- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- 3.12 FINAL CLEANING
- A. Execute final cleaning prior to Substantial Completion.
 - 1. Conduct cleaning and waste removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.
 - B. Employ experienced professional cleaners for final cleaning.
 - C. Use cleaning materials that are recommended by manufacturer or fabricator of the surface or equipment to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - D. Clean interior and exterior glass surfaces, including mirrors, exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
 - E. Clean interior and exterior hard surface finishes to a dirt free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces where intended to remain. Restore reflective surfaces to their original condition.
 - F. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - G. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
 - H. Clean plumbing equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
 - I. Clean debris and dust from limited access spaces including but not limited to, plenums, shafts, equipment vaults, manholes, attics, and similar spaces.
 - J. Clean debris and dust from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
 - K. Clean mechanical equipment and fixtures; wipe surfaces.
 - 1. Clean permanent filters and replace disposable filters of operating equipment.
 - 2. Clean exposed surfaces of diffusers, registers, and grilles.
 - 3. Clean ducts, blowers, coils and similar items.
 - 4. Remove excess lubrication and other foreign substances.
 - L. Clean electrical equipment and fixtures; wipe surface.
 - 1. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

- M. Clean Project site.
 - 1. Clean site, yards, and grounds, in areas disturbed by construction activities, including landscape developed areas, of rubbish, waste materials, litter, and other foreign substances.
 - 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - 3. Rake grounds that are neither planted nor paved to smooth, even textured surface.
 - 4. Remove tools construction equipment, machinery, and surplus material from Project site.
 - 5. Remove snow and ice to provide safe access to building.
- N. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
 - 2. Provide copies to Owner.
 - 3. Provide copies to Architect and Owner.
- B. Closeout Inspections Prior to Substantial Completion
 - 1. Contractor's Correction Punch List
 - a. Contractor is required to perform a preliminary inspection to determine and record items to be completed or corrected prior to Architect's inspection. Record of items to be completed and corrected shall be the Contractor's Correction Punch List and shall include a comprehensive list of items to be completed and/or corrected along with an estimated timeline in which all items on the list shall be resolved.
 - 1) Notify Architect a minimum of 10 days prior to the date the Contractor wishes the Architect's Substantial Completion Inspection be performed and only when work is considered ready for Architect's Substantial Completion Inspection. Along with notification, submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion Inspection.
 - a) Contractor may request Architect's Substantial Completion Inspection prior to resolving all items on the Contractor's Correction Punch List. Contractor must include with the request an updated Contractor's Correction Punch List indicating resolved items and incomplete items. Incomplete items shall be listed with value (cost) of incomplete item and explanation of why the work is not complete/resolved. Architect will determine if the Architect's Substantial Completion Inspection will be conducted or delayed pending resolution of additional Contractor's Corrective Punch List items.
 - b. Organization of Contractor's Correction Punch List
 - 1) Include name and identification of each space and area included within the work area or affected by the Work or where Work was performed and the items that are incomplete or require correction within those areas.
 - 2) Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest to highest floor.
 - 3) Organize items applying to each area by major element, including categories for ceiling, individual walls, floors, equipment, and building system.
 - 2. Architect's Substantial Completion Inspection

- a. Upon receipt of notification of the completion of the Contractor's Correction Punch List, Architect will either proceed with the inspection or notify the Contractor of unfulfilled requirements.
 - b. Upon acceptance of the Contractor's Correction Punch List, the Architect will perform the Architect's Substantial Completion Inspection. Architect will prepare the Certificate of Substantial Completion or will notify the Contractor of items, either on contractor's list or additional items identified by Architect, that must be complete or corrected prior to the issuance of a Certificate of Substantial Completion.
 - 1) Where items are required to be completed or corrected, the Contractor will notify the Architect that the identified items have been resolved and request a re-inspection.
 - 2) Results of completed Architect's Substantial Completion Inspection shall be the basis of requirements for Final Completion.
- C. Procedures Prior to Substantial Completion
 1. Complete the following items 10 days prior to the date the Contractor wishes the Architect's Substantial Completion Inspection be performed:
 - a. Advise Owner in writing of pending insurance changeover requirements.
 - b. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - c. Complete startup and testing of systems and equipment.
 - d. Perform preventative maintenance on equipment used prior to Substantial Completion.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training media specified in Section 01 7900 - Demonstration and Training.
 - f. Advise Owner of changeover of utilities.
 - g. Complete termination and removal of temporary facilities remaining.
 - h. Complete final cleaning requirements/procedures.
 2. Submit the following items 10 days prior to the date the Contractor wishes the Architect's Substantial Completion Inspection be performed:
 - a. Certificate of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities.
 - b. Closeout submittals specified in other Divisions including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information. See Section 01 7800 - Closeout Submittals for additional information.
 - c. Maintenance Materials: Provide maintenance material submittals specified in individual Section, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect or Owner.
 - d. Submit testing, adjusting, and balancing records.
 - e. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- D. Final Completion Procedures
 1. Procedures Prior to Final Completion
 - a. Prior to requesting Final Completion Inspection, complete the f
 - 1) Submit Final Application for Payment; See Section 01 2000 - Price and Payment Procedures.
 - 2) Submit certified list of incomplete items: Submit a certified copy of Architect's Substantial Completion Inspection list of items to be completed or corrected endorsed and dated by Contractor stating each item has been completed or otherwise resolved for acceptance.

- 3) Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4) Submit pest-control final inspection report.
 2. Final Completion Inspection
 - a. Submit a written request for Final Completion Inspection, to determine acceptance, a minimum of 10 days prior to the date the Work will be complete and ready for Final Completion Inspection. Upon receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate of Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1) Where items are required to be completed or corrected, the Contractor will notify the Architect that the identified items have been resolved and request a re-inspection.
 - E. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than two years from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 7000

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SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling and Salvage: The following may not be disposed of in landfills or by incineration. Items may be reused in Project only when specifically identified to be reused.
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Concrete: Pulverize to maximum 4-inch size; prepare to reuse on site where indicated or transport off-site to be re-used by others.
 - 6. Bricks: If indicated within Contract Documents, reuse whole bricks. If indicated within Contract Documents pulverize to maximum size indicated and utilize as indicated for re-use. Where not indicated for reuse on Project, stack whole pieces and package for shipping; pulverize partial pieces to maximum 4-inch size and transport off-s : May be used on project if indicated and if whole, otherwise transport off-site to be reused by other; Pulverize partial pieces or crushed and used as landscape cover, sub-base material, or fill.
 - 7. Concrete masonry units: If indicated within Contract Documents, reuse whole units. If indicated within Contract Documents pulverize to maximum size indicated and utilize as indicated for re-use. Where not indicated for reuse on Project, stack whole units and package for shipping; pulverize partial units to maximum 4-inch size and transport off-site to be re-used by others.
 - 8. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 9. Glass.
 - 10. Gypsum drywall and plaster.
 - 11. Plastic buckets.
 - 12. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
 - 13. Paint.
 - 14. Plastic sheeting.
 - 15. Rigid foam insulation.
 - 16. Windows, doors, and door hardware.
 - 17. Plumbing fixtures.

- 18. Mechanical and electrical equipment.
- 19. Fluorescent lamps (light bulbs).
- 20. Acoustical ceiling tile and panels.

- E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.
- F. Develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Illegal dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 2500 - Substitution Procedures.
- C. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- D. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- E. Section 01 6000 - Product Requirements: Waste prevention requirements related to product substitutions.
- F. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- G. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.3 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

- D. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- E. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- F. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- G. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- H. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- I. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- J. Return: To give back reusable items or unused products to vendors for credit.
- K. Reuse: To reuse a construction waste material in some manner on the project site.
- L. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- M. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- N. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- O. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- P. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- Q. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Submit Waste Management Plan within 10 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. Waste Management Plan: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).

3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - 1) For materials to be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. List the local market for each material.
 - c. State the estimated net cost, versus landfill disposal.
 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Owner.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.
- E. Recycling Incentive Programs:

1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

- A. See Section 01 6000 and Section 01 2500.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
 1. Relative amount of waste produced, compared to specified product.
 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 3. Proposed disposal method for waste product.
 4. Markets for recycled waste product.

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 1000 for list of items to be salvaged from the existing building for relocation in project or for Owner.
- B. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- D. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- E. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Prebid meeting.
 2. Preconstruction meeting.
 3. Regular job-site meetings.
 4. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 2. Provide containers as required.
 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 5. Locate enclosures out of the way of construction traffic.
 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 7419

SECTION 01 7610 - TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

1.2 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.3 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard.
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes available; and installation instructions.
- C. Shop Drawings: Indicate existing finished surfaces to be protected.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
 - 1. Water resistant.
 - 2. Vapor permeable.
 - 3. Impact resistant.
 - 4. Slip resistant.
 - 5. Flame retardant.

2.2 MATERIALS

A. Sheet Materials:

1. Corrugated polypropylene sheet.
2. Recycled paperboard/plastic composite sheet.
3. Recycled paperboard sheet.
4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch thick nominal.
5. Plywood, 1/2 inch thick nominal.
6. Fiberboard: ASTM C208, 1/2 inch thick nominal.
7. Size: 48 inch by 96 inch.
8. Thickness: 1/2 inch minimum.
9. Flame Retardance: Meet requirements of NFPA 701.
10. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Rolled Materials:

1. Self-adhering polyethylene film.
2. Recycled cellulose fiberboard paper.
3. Laminated glass fiber reinforced kraft paper.
4. Rosin coated paper.
5. Roll Width: 36 inch minimum.
6. Thickness: _____ inch.
7. Flame Retardance: Meet requirements of NFPA 701.
8. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

C. Corner and Door Jamb Protection Materials:

1. Cardboard, shaped specifically for application.
2. PVC plastic.
3. Length: 72 inch.

D. Tape: Type recommended by protective covering material manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- #### A.
- Remove dirt and debris from surfaces to be protected.

3.2 INSTALLATION

- #### A.
- Install in accordance with manufacturer's instructions.
- #### B.
- Trim or overlap sheet materials to fit area to be covered.
- #### C.
- Roll out and cut rolled materials to fit area to be covered.
- #### D.
- Tape seams. Avoid taping directly to finished surfaces.

- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.
- G. Position corner protection 4 inches above finished floor to 78 inches high.

3.3 REMOVAL

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION 01 7610

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SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Materials transparency manual.
- D. Warranties and bonds.

1.2 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect prior to Substantial Completion Inspection.
 - 1. Record Drawings:
 - a. Initial Submittal: Submit PDF electronic file of scanned record drawings.
 - 1) PDF files shall be a single file of all drawings. Drawings shall be labeled with sheet number and bookmarked.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record drawings incorporating comments and corrections made during Initial Submittal.
 - a) PDF files shall be a single file of all drawings. Drawings shall be labeled with sheet number and bookmarked.
 - 2) Submit one set of printed drawings.
 - 2. Record Product Data:
 - a. Submit PDF annotated PDF electronic files and directories of each submittal.
 - b. Where Record Product Data is required as part of the Operation and Maintenance Manual, submit duplicate marked up Record Product Data as a component of the maintenance manual.
 - 3. Miscellaneous Record Submittals: See other Sections for record keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

- B. Operation and Maintenance Data:
 - 1. Submit PDF electronic file. Assemble manual into a composite electronically indexed (book marked) file.
 - a. Preliminary Submission: Submit preliminary draft of format and outlines of content 30 days prior to commencement of demonstration and training. Architect will review preliminary draft and return copy with comments.
 - b. Initial Submission: Submit draft copy of manual(s) 15 days prior to final inspection. Architect will review and return after final inspection, with Architect's comments. Revise content of all documents as required for final submission.
 - c. Final Submission: Submit manual(s) in final form 15 days after receipt of Architect's comments of Initial Submission.
 - d. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
 - 1. Mark to show the actual installation where Installation varies from that shown originally.
 - 2. Give particular attention to information of concealed elements that would be difficult to identify or measure and record at a later time. verify mark-ups before enclosing concealed installations.
 - 3. Record data as soon as possible after obtaining.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first 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.
 - a. Revisions to routing of piping and conduits.
 - b. Duct size and routing.
 - c. Equipment locations.
 - d. Revisions to electrical circuitry.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
 - 6. Note identifying numbers of Architects Supplemental Instructions (ASI), Change Directives, Change Orders, construction sketches, and other modification documents.

3.2 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts. Cross-reference specification section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.

3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owners operating personnel for notification of installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
 - a. Product name and model number.
 - b. Manufacturer's name.
 - c. Equipment identification with serial number of each component.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 - a. Performance and design criteria if Contractor has delegated design responsibility.
 4. Complete nomenclature and model number of replaceable parts.

5. License requirements including inspection and renewal dates.
 - B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
 - C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
 - D. Include color coded wiring diagrams as installed.
 - E. Include piped system diagrams.
 - F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 - G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 2. Include Carbon Dioxide Monitoring Protocol.
 3. Include Carbon Monoxide Monitoring Protocol.
 4. Include Frost Mitigation Strategy for ventilation heat-recovery system.
 - H. Provide servicing and lubrication schedule, and list of lubricants required.
 - I. Include manufacturer's printed operation and maintenance instructions.
 - J. Include sequence of operation by controls manufacturer.
 - K. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - L. Provide control diagrams by controls manufacturer as installed.
 - M. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
 - N. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - O. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - P. Include test and balancing reports.
 - Q. Additional Requirements: As specified in individual product specification sections.
- 3.6 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS
- A. Directory:

1. Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - a. List of Documents
 - b. List of Systems
 - c. List of Equipment
 - d. Table of Contents.
 2. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 3. List of Equipment: List of equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 4. Table of Contents: Include a table of contents for each emergency, operation and maintenance manual.
- B. Organize operations and maintenance manuals following the example template appended to this document following this Section.
- C. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- D. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- E. Manuals, Physical
1. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
 2. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
 3. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
 4. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
 5. Dividers/Separation Pages: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
 6. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
 7. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- F. O&M Manual, Electronic: Combine PDF files of Cover, Project Directory, Table of Contents, and Separation Pages, Text/Copy/Data, and Drawings. Organize pdf in same manner as physical manual and bookmark each item.
1. Scan original physical documents to be included in the electronic manual where electronic versions do not exist. Document data size shall be reduced to smallest file size without data loss or reduction in legibility.
- G. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.7 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Warranty Manual, Physical: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
 1. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
 2. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
 3. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- G. Warranty Manual, Electronic: Combine PDF files of Cover, Table of Contents, and Separation Pages, and Warranties and Bonds. Organize pdf in same manner as physical manual and bookmark each warranty and bond.
 1. Scan original warranties and bonds to be included in the electronic manual.

END OF SECTION 01 7800

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INSERT OWNER LOGO HERE
IF OWNER DOES NOT HAVE LOGO,
INSERT COMPLETED PROJECT PHOTO OF ENTRY FAÇADE

OPERATION & MAINTENANCE MANUAL

VOLUME {#}

{PROJECT NAME}

{PROJECT ADDRESS LINE 1}

{PROJECT ADDRESS LINE 2}

DATE OF SUBSTANTIAL COMPLETION

{January 1, 0000}

Contractor: {Company Name}

{Point of Contract Name}

{Point of Contact Title}

{Address Line 1}

{Address Line 2}

Phone: {Phone Number}

E-mail: {Point of Contact E-mail}

Architect: Manns Woodward Studios Inc.

Architect of Record: David Woodward

{Point of Contact}

{Point of Contact Title}

8098 Sandpiper Circle, Suite H

Nottingham, Maryland 21236

Phone: 410-344-1460

E-mail: {Point of Contract E-mail}

{Contractors Company Name & Phone Number}

{PROJECT NAME}
OPERATION & MAINTENANCE MANUAL: VOLUME {#}

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Project Directory	{Page #s}
{Contractor's Company Name} Warranty	{Page #s}
Required Maintenance Schedules.....	{Page #s}
Division 01 – General Requirements.....	{Page #s}
Owners Additions	{Page #s}
Demonstration and Training Attendance Sign Off.....	{Page #s}
Division 02 – Demolition.....	{Page #s}
{Items Returned to Owner}	{Page #s}
{Recycled Items}.....	{Page #s}
{Salvaged Items}	{Page #s}
Division 03 – Concrete	{Page #s}
{Insert Items}	{Page #s}
Division 04 – Masonry.....	{Page #s}
{Insert Items}	{Page #s}

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Architectural.....	{Page #s}
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Fire Protection	{Page #s}

*****CONTINUE TABLE OF CONTENTS WITH APPLICABLE DICIPLINES*****

Page #

{Contractors Company Name & Phone Number}

{PROJECT NAME}

{Address Line 1}

{Address Line 2}

PROJECT DIRECTORY

OWNER

{Entity Name of Owner}

{Owner Address Line 1}

{Owner Address Line 2}

	Business Phone	Mobile Phone	E-Mail Address
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}

GENERAL CONTRACTOR

{Entity Name}

{Owner Address Line 1}

{Owner Address Line 2}

	Business Phone	Mobile Phone	E-Mail Address
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}

ARCHITECT

{Entity Name}

{Owner Address Line 1}

{Owner Address Line 2}

	Business Phone	Mobile Phone	E-Mail Address
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}

{Contractors Company Name & Phone Number}

{DESIGN TEAM MEMBER AS LISTED ON DRAWING COVER SHEET}

{Entity Name}

{Owner Address Line 1}

{Owner Address Line 2}

	Business Phone	Mobile Phone	E-Mail Address
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}

{SUBCONTRACTOR – list each separately}

{Entity Name}

{Owner Address Line 1}

{Owner Address Line 2}

	Business Phone	Mobile Phone	E-Mail Address
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}
{Point of Contact Name & Title}	{Phone #}	{Phone #}	{E-mail Address}

Page #

{CONTRACTORS WARRANTY, ON
COMPANY LETTERHEAD, SIGNED BY
COMPANY REPRESENTATIVE
AUTHORIZED TO SIGN BINDING
DOCUMENTS}

Page #

{Contractors Company Name & Phone Number}

{PROJECT NAME}
{Address Line 1}
{Address Line 2}

REQUIRED MAINTENANCE SCHEDULES

INCLUDE ALL REQUIRED MAINTENANCE FOR EQUIPMENT AND FINISHES

{Contractors Company Name & Phone Number}

Division {#}

{Division Title}

*****Division Separator Page (Electronic Manual);
Hyperlink or bookmark this page in the Table of Contents*****

*****Tab Divider (Physical Manual);
Print on Card Stock divider with numbered tab*****

Page #

{Contractors Company Name & Phone Number}

Division {#}

{Division Title}

*****LIST CONTENT OF EACH “DIVISION” SECTION ON THIS CONTENT PAGE*****

{Content Name}.....{Page #'s}
{Content Name}.....{Page #'s}

Page #

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

- A. Demonstration of products and systems 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. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Conveying systems.
 - 6. Landscape irrigation.
 - 7. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.
- C. Other Specification Sections: Additional requirements for demonstration and training.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
 - 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 as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: DVD Disc.
 - 2. Label each disc and container with session identification and date.

1.4 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

3.1 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. Demonstration may be combined with Owner personnel training if applicable.

- C. 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.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Provide training in minimum two hour segments.
- C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- D. 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.
- E. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- F. 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 01 7900

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SECTION 01 9113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with the Contract Documents, the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests such as manufacturers startup reports, balancing, and site demonstrations executed by the contractor and witnessed by the Commissioning Authority are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. The Commissioning Authority is employed by Construction Manager on behalf of Owner.

1.2 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
 - 1. HVAC System, including:
 - a. Major and minor equipment items.
 - b. Piping systems and equipment.
 - c. Ductwork and accessories.
 - d. Control system.
 - e. Variable frequency drives.
 - 2. Electrical Systems:
 - a. Lighting controls other than manual switches.
- B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.3 SUBMITTALS

- A. Product Data: If submittals to DEDC, LLC do not include the following, submit copies as soon as possible:
- B. Product Data: Submit to DEDC, LLC:
 - 1. Manufacturer's product data, cut sheets, and shop drawings.
 - 2. Manufacturer's installation instructions.
 - 3. Startup, operating, and troubleshooting procedures.
 - 4. Fan and pump curves.
 - 5. Factory test reports.
 - 6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.
- C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists/Start-up Documentation.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
 - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

- C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

- A. Commissioning Authority will prepare the Commissioning Plan.
 - 1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
 - 2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- D. Commissioning Schedule:
 - 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 30 days after award of Contract.
 - 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
 - 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 - 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 2 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority and DEDC, LLC.

3.3 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
 - 1. No sampling of identical or near-identical items is allowed.
 - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
 - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
- B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
 - 1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
 - 2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
 - 3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
 - 4. If any Checklist line item is not relevant, record reasons on the form.
 - 5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
 1. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 2. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
 3. When asked to review the proposed Checklists, do so in a timely manner.
- D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.4 FUNCTIONAL TESTS

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Commissioning Authority is responsible for witnessing results of Functional Tests.
- E. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
 2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
 3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered

defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.

F. Functional Test Procedures:

1. Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
 - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

- G. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.5 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

3.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

B. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION 01 9113

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Sequencing and staging requirements.
- C. Section 01 1000 - Summary: Description of items to be removed by Owner.
- D. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; Cutting and Patching; Alterations; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- G. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.3 DEFINITIONS

- A. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.5 PERFORMANCE REQUIREMENTS

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

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Survey of existing conditions;
 - 1. Indicate the following in addition to the existing conditions:
 - a. Vegetation to be protected.
 - b. Areas for temporary construction and field offices.
 - c. Areas for temporary and permanent placement of removed materials.
- C. Proposed Protection Plan: Submit report, including drawings that indicate proposed protection measures, locations of installation and barriers for:
 - 1. Individuals and property.
 - 2. Dust control.
 - 3. Noise control.
- D. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
 - 2. Ensure Owner's on site operations remain uninterrupted.
 - 3. Coordinate shutoff, capping, and continuation of utility services.
 - 4. Schedule of demolition activities with start and end dates.
 - a. Indicate start and end dates and times of utility service interruptions.
 - 5. Summary of safety procedures.
 - 6. Demolition firm qualifications.
- E. Project Record Documents:
 - 1. Accurately record actual locations of capped and active utilities and subsurface construction.
 - 2. Inventory: Submit list of items that have been removed and salvaged.
 - 3. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 COORDINATION

- A. Owner will occupy portions of existing building(s) immediately adjacent to demolition areas. Arrange selective demolition operations so as not to interrupt/interfere with Owner's operations.

1.8 PREINSTALLATION MEETINGS

- A. Selective Demolition Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss conditions of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - a. Review measures, procedures and plans for maintaining continued
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection
 - 7. Review procedures for noise control and dust control.
 - 8. Review procedures, delivery, storage, protection, and accounting for items to be removed and salvaged or reinstalled.
 - 9. Review existing warranties to remain and procedures required to maintain such warranties

1.9 MATERIAL OWNERSHIP

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

1.10 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of five years of documented experience.

1.11 FIELD CONDITIONS

- A. Conditions at time of inspection for bidding purposes will be maintained by Owner as far as practical.
- B. Notify Architect immediately upon discovery of discrepancies between existing conditions and Contract Documents. Do not proceed with demolition activities until receiving written notice from Owner/Architect to proceed.

1.12 HAZARDOUS MATERIALS

- A. It is not expected that hazardous materials will be encountered within the area(s) of Work.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before proceeding with demolition activities.
- B. Review Project Record Documents of existing construction or other existing condition or hazardous material information available. There is no guarantee that existing conditions match those indicated within the Project Record Documents available.
- C. Perform an engineering survey of condition of the building or structure to determine whether removing any element may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during demolition operations.
- D. Record Existing Conditions:
 - 1. Record existing conditions by use of preconstruction photographs or video.
 - 2. Inventory and record condition of items to be removed for salvage or reinstallation. Photograph conditions that might be misconstrued as damage caused by removal.
 - 3. Photograph or video record existing conditions of adjoining construction including finished surfaces, that might be misconstrued as damage caused by demolition operations.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with requirements in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- E. Protect existing structures and other elements to remain in place and not removed.

1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- H. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Comply with requirements of Section 01 7419 - Construction Waste Management and Disposal.
 2. Dismantle existing construction and separate materials.
 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- J. Salvaged/Reinstalled items
1. Removed and Salvaged Items:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - c. Store items in secure area until delivery to Owner.
 - d. Transport items to Owner storage area designated by Owner.
 2. Removed and Reinstalled Items:
 - a. Clean and repair items to functional condition adequate for intended reuse.
 - b. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - c. Protect items from damage during transport and storage.
 - d. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.3 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Coordinate work with Owner. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
- C. Protect existing utilities to remain from damage.
- D. Do not disrupt public utilities without permit from authority having jurisdiction.
- E. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

- F. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 5 days prior written notification to Owner.
- G. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- H. Demolition: Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
 - 1. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping materials.
 - 2. Ducts to be removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork materials.
 - 3. Equipment to be removed: Disconnect and cap services and remove equipment and components.
- I. Abandonment: Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - 1. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - 2. Ducts to be abandoned in place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- J. Remove and Reinstall or Salvage: Remove and reinstall or salvage existing building systems, equipment, and components indicated within Contract Documents to be removed and reinstalled or removed and salvaged.
 - 1. Equipment to removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
 - 2. Equipment to removed and salvaged: Disconnect and cap services and remove equipment and components, clean and deliver to Owner.
- K. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 - 1. Verify construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
 - 2. Provide sound retardant partitions of construction and in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

- D. Remove existing construction, systems, and equipment only to the extent required to accomplish new Work and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire-suppression devices during flame cutting operations.
 5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
 9. Remove items indicated on drawings.
 10. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. See Section 01 1000 - Summary for limitations on outages and required notifications.
 4. Verify that abandoned services serve only abandoned facilities before removal.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
1. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - a. Strengthen or add new supports when required during progress of demolition.
 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch to match new work.
- G. Protect persons and property; provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings, facilities and other property to remain.

1. Provide protection to ensure safe passage of people around demolition area(s) and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Existing items to remain: Protect items indicated to remain against damage and soiling during selective demolition. When permitted by Owner or Architect, items may be removed to a suitable, protected storage location, cleaned, and reinstalled in their original locations after selective demolition operations are completed.

H. Warranties

1. Remove, replace, patch, and repair materials and surfaces cut or damaged
2. Notify Warrantor before proceeding with selective demolition work,
3. Notify Warrantor upon completion of Work and obtain documentation verifying that the existing system has been inspected and the original warranty remains in effect. Submit documentation at Project Closeout.

3.5 DEBRIS AND WASTE REMOVAL

- A. Remove demolition waste, debris, junk, and trash from site.
 1. Comply with Section 01 7419 - Construction Waste Management and Disposal.
 2. Where required by Authority Having Jurisdiction, dispose of waste in an EPA-approved construction and demolition waste landfill acceptable to the AHJ.
 3. Do not allow demolished materials to accumulate on site.
 4. Remove and transport waste in a manner that will prevent spillage on adjacent surfaces, roadways, driveways and other areas.
- B. Remove debris from elevated portions of buildings or structures by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 4100

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Masonry walls.
- B. Related Sections:
 - 1. Section 02300 "Earthwork" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete mixture. Include alternate mix when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Formwork: Shop Drawings of typical areas of forms and concrete work shall be submitted prior to fabrication and assembly. Show and coordinate layout and arrangement of construction joints, form panel joints and spacing of wall form ties for the full height of each wall. Review of shop drawings is for general conformance to member dimensional requirements and architectural applications and features only. The design of the formwork for structural stability and sufficiency shall be the Contractor's responsibility. Shop drawings submittal shall be signed and sealed by Professional Engineer registered in the state in which the Project is located. Shop drawing submittal shall include and clearly indicate but not limited to the following:
1. Size, type and quality of form materials including conditions at tops and ends of walls. (If wood is used, indicate species.)
 2. Detailed form construction indicating structural stability and joining including special form joints or reveals required by Contract Documents.
 3. Location and pattern of form tie placement, and other items that affect the appearance of concrete that will remain exposed to view.
 4. Form finish clearly indicating proper locations and full coordination with concrete finishes required by Contract Documents.
 5. The design loads and rate of placing concrete shall be noted on shop drawings.
 6. Product Data: Copies of manufacturers' product data and installation instructions or proprietary materials used in exposed concrete work, including form liners, release agents, manufactured form systems, ties, and accessories.
 7. Compatibility Certification: Contractor shall certify that form release agent used is compatible with subsequent architectural finish materials applied to concrete surfaces. Submit along with manufacturer's data.
 8. Installation Certificate: Contractor shall certify that formwork meets requirements of Contract Documents including allowable tolerances.
 9. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
 10. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 11. Location of construction joints is subject to approval of the Architect.
- E. Welding certificates: Copies of certificates for welding procedures and personnel.
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Fiber reinforcement.
 6. Waterstops.
 7. Curing compounds.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor retarders.
 12. Semirigid joint filler.
 13. Joint-filler strips.
 14. Repair materials.

- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- H. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
 - 1. Floor slabs shall be finished to a minimum flatness F-number Ff=30 and a minimum levelness F-number Fl=25 in any direction (U.N.O.).
 - 2. Exterior concrete stairs shall have the treads and landings sloped approximately 1/8" per 12" to assure that no water rests on a riser or the landing.
- I. Field quality-control reports.
 - 1. Submit results of compression cylinders and grout cubes.
 - 2. Test Reports: Including strength and density of furnished product.
 - 3. Inspection reports: certifying rebar and welded wire fabric placement, etc.
- J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

- G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
 - 1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Avoid damaging coatings on steel reinforcement.
 - 2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Reinforcing Bars: ASTM A 615/, Grade 60, deformed.
- C. Galvanized Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775 or ASTM A 934, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

2.3 FIBER REINFORCING

- A. Synthetic Macro-Fiber: Synthetic macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, 1-1/2" long minimum.

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60 . Cut bars true to length with ends square and free of burrs.
- C. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.
- D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
- E. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II supplement with the following which shall not exceed 25% by weight of the total cementitious material:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Severe weathering region, not less than 3S.
 - 2. Nominal Maximum Coarse-Aggregate Size: 1-1/2 inch (3/4 inch maximum for concrete poured on metal deck).
 - 3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
 - 4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4 inch nominal maximum aggregate size.
- D. Water: Potable and complying with ASTM C 94.

2.6 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.7 VAPOR RETARDERS

- A. Vapor Retarder: polyethylene sheet, ASTM D 4397, not less than 10 mils thick.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- I. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Evaporation Retarder:

- a. Spray-Film; ChemMasters.
 - b. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
 - c. Sure Film; Dayton Superior Corporation.
 - d. Eucobar; Euclid Chemical Co.
 - e. Vapor Aid; Kaufman Products, Inc.
 - f. E-Con; L&M Construction Chemicals, Inc.
 - g. Confilm; Master Builders, Inc.
 - h. SikaFilm; Sika Corporation.
2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:
- a. Spray-Cure & Seal 15; ChemMasters.
 - b. Conspec #1-15 percent solids; Conspec Marketing & Manufacturing Co., Inc.
 - c. Day-Chem Cure and Seal; Dayton Superior Corporation.
 - d. Diamond Clear; Euclid Chemical Co.
 - e. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
 - f. CS-309; W. R. Meadows, Inc.
 - g. Acrylic Cure; Unitex.
 - h. Certi-Vex AC 309; Vexcon Chemicals, Inc.
3. Clear, Waterborne, Membrane-Forming Curing Compound:
- a. Safe-Cure & Seal 20; ChemMasters.
 - b. High Seal; Conspec Marketing & Manufacturing Co., Inc.
 - c. Safe Cure and Seal; Dayton Superior Corporation.
 - d. Diamond Clear VOX; Euclid Chemical Co.
 - e. SureCure; Kaufman Products Inc.
 - f. Dress & Seal WB; L&M Construction Chemicals, Inc.
 - g. Vocomp-20; W. R. Meadows, Inc.
4. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:
- a. Spray-Cure & Seal Plus; ChemMasters.
 - b. Lumiseal Plus; L&M Construction Chemicals, Inc.
 - c. CS-309/30; W. R. Meadows, Inc.
5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
- a. Polyseal WB; ChemMasters.
 - b. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
 - c. Vocomp-30; W. R. Meadows, Inc.

2.9 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type: Class II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 2. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 3. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- E. Flexible Joint Sealant: Two-component waterproof material that bonds securely to clean concrete surfaces.
1. Acceptable Products:
 - a. SikaFlex-2C NS as manufactured by Sika Corporation.
 - b. Or approved equal.
- F. Expansion Joint Filler: Expansion Joint Filler ASTM D1752, Type III preformed.
- G. Swelling type waterstop, where specifically shown, shall be Polyurethane type extrudable swelling type waterstop such as Sikaswell S-2 as manufactured by Sika Corporation or approved equal.
- H. Hydrophilic water stops, where specifically indicated on drawings. Use pre-molded shape and size as shown. Acceptable products are Hydrotite as manufactured by Greenstreak, or approved equal.
- I. Non-metallic Non-shrink Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C588. Mix and placed according to the manufacturer's recommendations.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings, Grade Beams, Piers, ICF walls, Foundation and Retaining Walls Unless Noted Otherwise: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Minimum Cementitious Materials Content: 611 lb/cu. yd.
 3. Maximum Water-Cementitious Materials Ratio: 0.45 maximum.
 4. Slump Limit: 4 inches plus or minus 1 inch.
 5. Air Content: Used in concrete exposed to weather. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 7.0 percent, unless otherwise indicated.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
 3. Maximum Water-Cementitious Materials Ratio: 0.50 maximum.
 4. Slump Limit: 4 inches plus or minus 1 inch.
 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Exterior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
 3. Maximum Water-Cementitious Materials Ratio: 0.45 maximum.
 4. Slump Limit: 4 inches plus or minus 1 inch.

5. Air Content: Used in concrete exposed to weather. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 7.0 percent, unless otherwise indicated.

D. Slabs on Deck and Topping Slabs: Proportion light-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
3. Maximum Water-Cementitious Materials Ratio: 0.45 maximum.
4. Slump Limit: 3 inches plus or minus 1 inch.
5. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 4.0 to 7.0 percent, unless otherwise indicated.

E. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.13 MASONRY GROUT MIXTURE

A. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
3. Maximum Water-Cementitious Materials Ratio: 0.60 maximum.
4. Slump Limit: Water may be introduced at the plant to produce a maximum slump of 6". Additional water may be added at the jobsite immediately prior to placement to produce a maximum slump of 8".

B. Mix Design: Proportion per the requirements of ASTM C476-83 - "Standard Specification for Grout for Masonry" ready mixed and transported in accordance with ASTM C-94, alternate No. 1 and ACI 304.

C. Mixing: After introduction of water to the cement and aggregates, concrete which has been mixed longer than 1.5 hours should not be placed. Because of its high slump, ready mix grout shall be continuously agitated after mixing until placement. In no case shall concrete be used that has been mixed so long that the initial set of the concrete shall occur sooner than 15 minutes after placement.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class C, 1/2 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Do not chamfer corners or edges of concrete.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.
 - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. 28-day design compressive strength.
 - 2. At least 70 percent of 28-day design compressive strength.
 - 3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 - 4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- B. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.
- C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) 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, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 2. Do not apply rubbed finish to smooth-formed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or dar-bied. Use stiff brushes, brooms, or rakes.
1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: County will hire a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

**West View Fire Station 31
Frederick MD, 21703
Proj No: 23-140**

**MW STUDIOS
100% CONSTRUCTION DOCUMENTS
May 23, 2025**

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete formwork.
- B. Concrete reinforcement.
- C. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.
- D. Concrete curing.

1.2 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; 2016.
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI 305R - Guide to Hot Weather Concreting; 2010.
- F. ACI 306R - Guide to Cold Weather Concreting; 2016.
- G. ACI 308R - Guide to External Curing of Concrete; 2016.
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- I. ACI 347R - Guide to Formwork for Concrete; 2014.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018, with Editorial Revision (2018).
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- N. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.

- O. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.
- P. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- Q. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- S. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2015.
- T. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
 - 1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

1.5 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
- B. Reinforcement Accessories:
 1. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 1. Color(s): As indicated on drawings.
 2. Manufacturers:
 - a. BRICKFORM; BRICKFORM Liquid Integral Color: www.brickform.com/#sle.
 - b. Butterfield Color; _____: www.butterfieldcolor.com/#sle.
 - c. Davis Colors; ____: www.daviscolors.com/#sle.
 - d. Euclid Chemical Company; COLOR-CRETE: www.euclidchemical.com/#sle.
- G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 ACCESSORY MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, clear polyethylene, or white polyethylene.

2.5 CURING MATERIALS

- A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

2.6 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to DEDC, LLC for preparing and reporting proposed mix designs.
- C. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As scheduled in part 3.09.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 - 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 - 5. Maximum Aggregate Size: 5/8 inch.

2.7 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
 - 1. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Verify that anchors, seats, plates, duct spacers, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.5 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.

3.6 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. 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.
 - 1. Normal concrete: Not less than seven days.
 - 2. High early strength concrete: Not less than four days.

C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.

3.7 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.8 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to DEDC, LLC and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the DEDC, LLC. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.9 SCHEDULE - CONCRETE TYPES AND FINISHES

- A. Generator Foundation: 4,500 PSI 28 day concrete, form finish with honeycomb filled side surfaces, level float finish top surface.

- B. Conduit Duct Bank: 3,000 PSI 28 day concrete, side surfaces cast against earth or forms, level top surface with red pigment.

END OF SECTION 03 3000

SECTION 04 0511 - MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.2 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

1.3 REFERENCE STANDARDS

- A. ASTM C91/C91M - Standard Specification for Masonry Cement.
- B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- C. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- D. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- E. ASTM C476 - Standard Specification for Grout for Masonry.
- F. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- G. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- H. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- I. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.
- J. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.
- K. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- L. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.
- M. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.
- N. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.4 SUBMITTALS

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

- B. Product Data:
 - 1. For each type of product.
 - 2. For each type of mortar and grout, include description of design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of each pigmented and color-aggregate mortar, illustrating mortar color and color range. Make samples using same sand and mortar ingredients to be used on Project.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.
- H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- I. Cold-Weather and Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements. It is the Contractors responsibility to determine sequence of Work and project schedule. As such it is the Contractors responsibility to provide within their work scope cold weather and/or hot weather procedures as required to complete the Work within the approved schedule.

1.5 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.

1.6 PRECONSTRUCTION TESTING

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000 - Quality Requirements.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
 - 1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.
- C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
 - 1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in dry location. Do not use cementitious materials that have become damp or wet.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- D. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.8 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
 - 2. Do not build on frozen substrates.
 - 3. Cold weather cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT APPLICATIONS

- A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.
 - 1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.
- B. Mortar Color for Hidden Masonry Applications: Natural gray unless otherwise indicated.
- C. Mortar Color for Exposed Masonry Applications: Use pigmented mortar to produce color required.
- D. Mortar Mix Designs: ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. Historic Exterior Masonry Pointing Mortar: Type O; color to match existing.
 - 2. Masonry below grade and in contact with earth: Type S.
 - 3. Exterior Masonry Veneer: Type N.
 - 4. Exterior Cavity Walls: Type S mortar with Type N pointing mortar.
 - 5. Exterior, Loadbearing Masonry: Type N.
 - 6. Exterior, Non-loadbearing Masonry: Type N.
 - 7. Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
 - 8. Interior, Loadbearing Masonry: Type N.
 - 9. Interior, Non-loadbearing Masonry: Type N; Type O may be used

10. Pointing Mortar for Prefaced or Specially Faced Unit Masonry: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

E. Grout Mix Designs:

1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.2 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason's sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Type: Types as scheduled in this section.
 2. Exposed Mortar Color: Mineral pigments added as required to produce approved color sample.
 3. Water repellent mortar for use with water repellent masonry units.
- B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
1. Type: Use grout of type indicated, or if not indicated, of type (fine or course) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.
- C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Color(s): As indicated on drawings.
 2. Manufacturers: Provide products complying with requirements, from one of the following manufacturers.
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lambert Corporation; Mortar Color.
 - c. Solomon Colors; SGS Mortar Colors.
- D. Water: Clean and potable.
- E. Admixtures
1. Cold Weather Accelerating Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 2. Bonding Agent: Epoxy type.
 3. Integral Water Repellent Admixture: Polymeric liquid admixture added to mortar at the time of manufacture.
 - a. Performance of Mortar with Integral Water Repellent:
 - 1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:
 - a) No water visible on back of wall above flashing at the end of 24 hours.

- b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
- c) No more than 25 percent of wall area above flashing visibly damp at end of test.
- 2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
- 3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
- b. Use only in combination with masonry units produced with integral water repellent admixture.
- c. Product: Subject to compliance with requirements, provide one of the following or comparable product by another manufacturer.
 - 1) ACM Chemistries; RainBloc for Mortar.
 - 2) Master Builders Solutions; MasterPel 240MA.
 - 3) GCP Applied Technologies.; Dry-Block Mortar.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.4 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.1 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.2 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.3 GROUTING

- A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 60 inches.
 - 2. Limit height of masonry to 16 inches above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

3.4 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense. Perform field tests, in accordance with provisions of Section 01 4000 - Quality Requirements.
- B. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement
 - 3. Place grout only after inspectors have verified proportions of prepared
- C. Test and evaluate mortar in accordance with ASTM C780 procedures.
 - 1. Test Prior to Construction: One set of tests.
 - 2. Test Frequency: Once set of tests for each 5000 s.f. of wall area or portion thereof.
 - 3. Test with same frequency as specified for masonry units.
- D. Test and evaluate grout in accordance with ASTM C1019 procedures.
 - 1. Test with same frequency as specified for masonry units.

END OF SECTION 04 0511

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 04 0511 - Masonry Mortaring and Grouting.
- B. Section 05 5000 - Metal Fabrications: Loose steel lintels.
- C. Section 06 1000 - Rough Carpentry or 06 1053 - Miscellaneous Rough Carpentry: Nailing strips built into masonry.
- D. Section 07 1113 - Bituminous Dampproofing: Dampproofing parged masonry surfaces.
- E. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
- F. Section 07 2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS: Air barriers applied to exterior face of backing sheathing or unit masonry substrate.
- G. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- H. Section 07 8413 - PENETRATION FIRESTOPPING: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- I. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

- C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
- D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- G. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- H. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
- I. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
- J. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- K. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
- L. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
- M. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
- N. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
- O. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- P. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
- Q. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
- R. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- S. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- T. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.
- U. ASTM C1283 - Standard Practice for Installing Clay Flue Lining.
- V. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- W. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- X. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.
- Y. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls.

- Z. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.
- AA. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls.
- BB. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.
- CC. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- DD. UL (FRD) - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each product type including, but not limited to, masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
 - 1. Masonry Units: Indicate sizes (dimensions), profiles, coursing, and locations of special shapes.
 - 2. Indicate anchorage, size and type of fasteners
 - 3. Reinforcing Steel: Detail bending, laps, lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
 - 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
 - 5. Indicate locations of expansion and control joints on elevations where elevation of walls is provided within Contract Documents. Otherwise show locations of joints on plans.
- D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
 - 1. Initial Samples:
 - a. Masonry Units: Submit, in the form of small scale samples, two samples of decorative block units for initial selection verification.
 - b. Colored Mortar: Submit two color sample selection kits.
 - c. Weep Vents: Submit color selection kit/ring.
 - 2. Final Sample Verification:
 - a. See "MOCK-UPS" article below for sample panels.
- E. Manufacturer's Certificate:
 - 1. Certify that masonry units meet or exceed specified requirements.
 - 2. Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
 - 3. Cementitious Materials: Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirements.
- G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- H. Cold-Weather and Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements. It is the Contractors responsibility to determine sequence of Work and project schedule. As such it is the Contractors responsibility to provide within their work scope cold weather and/or hot weather procedures as required to complete the Work within the approved schedule.
- I. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- J. Designer's Qualification Statement.
- K. Manufacturer's Qualification Statement.
- L. Installer's Qualification Statement.
- 1.6 QUALITY ASSURANCE
- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
1. Maintain one copy of each document on project site.
- B. Fire Rated Assemblies: Comply with requirements for fire resistance rated assembly designs indicated within Contract Documents.
- C. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- F. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.7 MOCK-UPS AND SAMPLE PANELS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects.
 - 1. Build panels for each exposed unit masonry construction in sizes approximately 48 inches square by full thickness.
 - 2. Build panels facing south.
 - 3. Where masonry is to match existing, build panels adjacent and parallel to existing surface being matched.
- B. Protect accepted sample panels with weather resistant membrane.
- C. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities to be specifically approved by Architect
 - 1. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
 - 1. Store on elevated platform in dry location.
 - 2. Cover units to prevent soiling or becoming wet; If units become wet, dry before installation.
- B. Pre-blended, dry mortar mixes: deliver pre-blended, dry mortar mix in moisture resistant containers. Store pre-blended, dry mortar mix in delivery containers on elevated platforms in dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Installed Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings

4. Turn scaffold boards neat wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 1. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Concrete Block, General: Comply with referenced standards and as follows:
 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 2. Special Shapes: Provide nonstandard blocks with exposed surfaces matching exposed faces of adjacent units and configured for corners, lintels, headers, jambs, sashes, control joint edges, bonding, and other detailed conditions.
 - a. Provide bullnose units for outside corners of exposed units unless otherwise indicated.
 3. Integral Water Repellent: Provide units with integral water repellent that are visible and are exposed to weather/weathering (exterior units) and direct water contact (interior units). Interior units that are subject to direct water contact are exposed masonry units located within apparatus or vehicle bays, kitchens, equipment/utility service areas, janitorial, toilet/shower rooms, locker rooms, storage, and other similar rooms/areas.
 - a. Polymeric liquid admixture added to concrete masonry units at time of manufacture.
 - b. Performance of Units with Integral Water Repellent:
 - 1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
 - a) No water visible on back of wall above flashing at the end of 24 hours.
 - b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
 - c) No more than 25 percent of wall area above flashing visibly damp at end of test.
 - 2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
 - 3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
 - c. Use only in combination with mortar that also has integral water repellent admixture.
 - d. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
 4. Load-Bearing Units: ASTM C90, normal weight.
 - a. Unit Compressive Strength: Provide units with minimum average net compressive strength of 2150 psi.
 5. Nonloadbearing Units: ASTM C129, normal weight.
 - a. Unit Compressive Strength: Provide units with minimum average net compressive strength of 1900 psi.

6. Common/Standard Block Units
 - a. Smooth face units.
 - b. Color: Gray
7. Decorative Block Units
 - a. Split Face Units
 - 1) Basis of Design Product: Subject to compliance with requirements, provide basis of design product indicated or one of the other products listed.
 - a) York Building Products; Split Face.
 - b) Echelon Standard Masonry; Split Face.
 - c) Nitterhouse Masonry Products; Split Face Block.
 - d) Basis of Design: Westbrook Concrete Block; Split Face.
 - 2) Bond/Pattern: Running.
 - 3) Joint: Concave
 - 4) Color: As indicated on drawings.
 - b. Ground Face Units; Standard Unit; _____
 - 1) Basis of Design Product: Subject to compliance with requirements, provide basis of design product indicated or one of the other products listed.
 - a) York Building Products; Gemstone.
 - b) Echelon Masonry, Trenwyth Architectural Masonry; Trendstone.
 - c) Nitterhouse Masonry Products; Ground Face Block.
 - d) Basis of Design: Westbrook Concrete Block; Ground Face.
 - 2) Bond/Pattern: Running.
 - 3) Joint: Concave
 - 4) Color: As indicated on drawings

2.2 BRICK UNITS

- A. Facing Brick: ASTM C216, Type FBX, Grade SW.
 1. Match existing brick.
 2. Basis of Design Product: Subject to compliance with requirements, provide basis of design product indicated or comparable product by another manufacturer.
 3. Bond/Pattern: Running.
 4. Joint: Concave
 5. Color: As indicated on drawings.
 6. Actual size: Modular: 3-5/8 x 2-1/4 x 7-5/8 inches.
 7. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 8. Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

2.3 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 0511.

2.4 REINFORCEMENT AND ANCHORAGE

A. Reinforcement

1. Uncoated Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (60,000 psi).
2. Masonry Joint Reinforcement, General: ASTM A951/A951M.
 - a. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - b. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
 - c. Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
3. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - a. Type: Truss or ladder.
 - b. Interior Wall Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 - c. Exterior Wall Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 - d. Size: 0.1483 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
4. Multiple Wythe Joint Reinforcement with Mortar Joint Between Wythes: ASTM A951/A951M.
 - a. Type: Truss.
 - b. Interior Wall Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 - c. Exterior Wall Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 - d. Size: 0.1875 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
5. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
 - a. Type: Truss, with adjustable pintle and eye ties spaced at 16 in on center.
 - 1) Reinforcement shall have one side rod at each face of masonry shell of backing wythe.
 - 2) Ties shall not have more than 1/16 inch play in any horizontal direction.
 - 3) Ties shall be sized to extend minimum of half facing wythe but not extend more than 5/8 inch from face of facing wythe.
 - b. Material: stainless steel complying with ASTM A580/A580M Type 304.
 - c. Size: 0.1875 inch side rods with 0.1875 inch cross rods and adjustable components of 0.1875 inch wire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.
 - d. Vertical adjustment: Not more than 1 1/4 inches.
 - e. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

B. Ties and Anchors

1. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.
2. Partition Top Anchor: 0.105 inch thick metal plate with a 3/8 inch diameter metal rod 6 inches long welded to metal plate and with closed end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot dip galvanized after fabrication.

3. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
 - a. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - b. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
4. Masonry Veneer Anchors: Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling single-barrel screw with thermally resistant wingnut head designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation with factory installed gasketed washer to seal at face of insulation and sheathing. Provide with seismic tie, clip, and continuous wire in veneer.
 - a. Barrel: Stainless steel, AISI Type 304; ASTM A580/A580M.
 - b. Screw: Carbon steel; ASTM A510/A510M. Polymer Coating; ASTM C954
 - c. Wire: Stainless steel, AISI Type 304; ASTM A580/A580M
 - d. Basis of Design Product: Subject to compliance with requirements, provide basis of design product indicated or comparable product by another manufacturer.
 - 1) Basis of Design: Hohmann & Barnard, Inc.;
 - 2) Basis of Design: Hohmann & Barnard, Inc.;
 - a) Concrete, Masonry, Wood Framing: Thermal Concrete 2-Seal Wing Nut Anchor.
 - b) Metal Framing: Thermal 2-Seal Wing Nut Anchor.
 - c) Pintle: Mighty-Lok Hook.

2.5 FLASHINGS

- A. Application: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with metal drip edge.
 4. Where flashing is fully concealed, use flexible flashing.
- B. Metal Flashing: Provide metal flashing complying with 07 6200 - Sheet Metal Flashing and Trim and as follows:
 1. Stainless Steel Flashing: ASTM A666/A666M, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.
 2. Fabricate continuous flashing in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 3. Fabricate through wall metal flashing embedded in masonry from stainless steel, with ribs at 3 inch intervals along length of flashing to provide an integral mortar bond.
 4. Fabricate through wall flashing with snap lock receiver on exterior face where indicated to receive counterflashing.
 5. Fabricate through wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 6. Fabricate metal expansion joint strips from stainless steel to shapes indicated.
 7. Solder metal items at corners.
 8. Prefabricated Metal Flashing: Sawtooth fabricated 16 oz/sq ft stainless steel (type 304) flashing for thru-wall conditions.

- a. Manufacturers: Provide products complying with requirements, from one of the following manufacturers.
 - 1) Cheney Flashing Company.
 - 2) Hohmann & Barnard, Inc.
 - 3) WIRE-BOND.
 - C. Flexible Flashing
 - 1. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
 - a. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
 - 1) Basis of Design Product: Subject to compliance with requirements, provide basis of design product indicated or comparable product by another manufacturer.
 - a) Basis of Design: York Flashings; Flash-Vent SS.
 - D. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
 - 1. Manufacturers: Provide products complying with requirements, from one of the following manufacturers.
 - a. 3GEN Masonry Products.
 - b. Hohmann & Barnard, Inc.
 - c. Mortar Net Solutions.
 - d. WIRE-BOND.
 - e. York Flashings.
 - E. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.
 - F. Termination Bars: Stainless steel; compatible with membrane and adhesives.
 - G. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
 - H. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.
- 2.6 ACCESSORIES
- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints; ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall.
 - 1. Manufacturers: Provide products complying with requirements, from one of the following manufacturers.
 - a. Blok-Lok Limited.
 - b. Hohmann & Barnard, Inc.
 - c. WIRE-BOND.
 - B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; in maximum lengths available.

1. Manufacturers: Provide products complying with requirements, from one of the following manufacturers.
 - a. Hohmann & Barnard, Inc.
 - b. WIRE-BOND.
 - C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Locations: Provide continuous cavity drainage material within masonry wall cavity, directly on top of through wall flashing and protecting veneer weeps, at every through wall flashing line, whether specifically indicated in drawings or not; and elsewhere where specifically indicated.
 - b. Product: Subject to compliance with requirements, provide one of the following or comparable product by another manufacturer.
 - 1) 3GEN Masonry Products; Wall Defender.
 - 2) Advanced Building Products, Inc; Mortar Break DT.
 - 3) Advanced Building Products Inc; Mortar Break.
 - 4) Mortar Net Solutions; MortarNet.
 - 5) WIRE-BOND.
 - 6) York Flashings.
 - D. Cavity Vents:
 1. One-piece flexible extrusion; full height and width of head joint and depth 1/8 inch less than depth of outer wythe.
 2. Type: Extruded propylene with honeycomb design.
 3. Color: As selected from manufacturer's full range.
 4. Product: Subject to compliance with requirements, provide one of the following or comparable product by another manufacturer.
 - a. 3GEN Masonry Products; Cell Vent.
 - b. Advanced Building Products, Inc; Weep Vents.
 - c. Blok-Lok Limited; Cellvent.
 - d. Hohmann & Barnard, Inc; QV Quadro-Vent.
 - e. Mortar Net Solutions; CellVent.
 - f. Heckmann Building Products, Inc; Cell Vent No. 85.
 - g. WIRE-BOND; Cell Vent.
 - E. Chimney Cap: Precast concrete, sized to cover chimney construction plus additional overhang for drip on four sides, thickness as indicated, sloped from flue opening to edges for natural drainage.
 - F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- 2.7 LINTELS
- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam units matching adjacent units in color texture, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less than half size units particularly at corners, jambs, and where possible, at other locations.

3.3 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 PLACING AND BONDING

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
 - 1. Units shall not be mitered to form corners; provide special shapes where necessary to form corners with finished faces.
- D. Exposed Masonry: Mix units to produce uniform blend of colors and textures, unless otherwise indicated.
- E. Where existing masonry occurs, match coursing, bonding, color, and texture of existing masonry.

- F. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern; do not use units with less than nominal 4 inch horizontal face dimension at corners or jambs.
- G. Lay concealed masonry with all units in a wythe in running bond pattern. Bond and interlock each course of each wythe at corners. Do not use units with less than 4 inch horizontal face dimension at corners or jambs.
- H. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work. Do not deeply furrow bed joints or slush head joints.
- I. Lay hollow masonry units as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- J. Where applicable set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- K. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- L. Remove excess mortar and mortar smears as work progresses.
- M. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- N. Interlock intersections and external corners, except for units laid in stack bond.
- O. Rake out mortar joints at pre-faced CMUs to uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy mortar manufacturer's written instructions.
- P. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- Q. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- R. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- S. Cut mortar joints flush where wall tile is scheduled, plaster is scheduled, other direct applied finishes (other than paint) is scheduled, resilient base is scheduled, cement parging is required, cavity insulation vapor barrier adhesive is applied, bitumen dampproofing is applied, or other membrane coating is applied.
- T. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

2. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
 3. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2 inch clearance between end of anchor rod and end of tube. Space anchors 48 inches on center unless otherwise indicated.
 4. At fire rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8400 - Firestopping.
- U. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- V. Lay clay tile flue linings vertically, embedded in concrete block units.
1. Install in accordance with ASTM C1283.
 2. Extend above chimney cladding 8 inches.
 3. Trowel mortar smooth over chimney cladding and slope for positive drainage.
- W. Place precast chimney cap atop chimney masonry; mortar into place; seal to protruding flue.
- 3.5 WEEPS/CAVITY VENTS
- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels and near top of walls.
- 3.6 CAVITY MORTAR CONTROL
- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Where air space in cavity wall assemblies is 1-1/2 inches or less, install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.
 2. Hold cavity mortar control panel tight to face wythe.
 3. Install horizontally between joint reinforcement.
 4. Stagger end joints in adjacent rows.
 5. Fit to perimeter construction and penetrations without voids.
- D. Where air space in cavity wall assemblies is greater than 1-1/2 inches, install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.7 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
 - 1. Unless otherwise indicated, install horizontal joint reinforcement 16 inches on center.
 - 2. Horizontal joint reinforcement in parapets and foundation walls shall be spaced not more than 8 inches on center.
 - 3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 24 inches each side of opening.
 - 4. Place continuous joint reinforcement in first and second joint below top of walls.
- B. Lap joint reinforcement ends minimum 6 inches.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at wall corners by using prefabricated L-shaped units.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- F. Reinforced Unit Masonry
 - 1. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - a. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
 - 2. Placing Reinforcement: Comply with requirements in TMS 402/602.
 - 3. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - a. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - b. Limit height of vertical grout pours to not more than 60 inches.
- G. Anchoring Masonry to Structural Steel and Concrete:
 - 1. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - a. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - b. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - c. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed adjustable multiple wythe joint reinforcement within back-up wythe with pintle and eye veneer anchors (ties) embedded in veneer wythe at maximum 16 inches on center vertically and horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

- B. Masonry or Concrete Back-Up, Thermally Broken: Fasten masonry veneer anchors into masonry back-up and embed pintle and eye veneer anchors (ties) within veneer wythe at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- C. Stud Back-Up, Thermally Broken: Secure veneer anchors to stud framed back-up and embed pintle and eye veneer anchors (ties) within veneer wythe at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- D. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.9 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

- A. Use multiple wythe joint reinforcement installed in horizontal joints to bond wythes together. Space horizontal joint reinforcement as indicated in REINFORCEMENT AND ANCHORAGES - GENERAL article above.

3.10 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing.
 - 2. Where flashing is within mortar joint, place through wall flashing on sloping bed of mortar and cover with mortar.
 - 3. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry; turn up flashing ends at least 1 inch, minimum, to form watertight pan.
 - 4. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. At multiple wythe masonry walls, including cavity walls, extend flashing through outer wythe, turn up a minimum of 8 inches, turn and extend through inner wythe to within 1/2 inch of interior face of exposed masonry wall. Where interior masonry wall is covered with furring or other construction assembly continue flashing through inner wythe and turn up interior face 2 inches.
- C. Framed or concrete walls with masonry veneer, terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
 - 2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
 - 3. Terminate vertical leg of flashing into reglet in concrete.
 - 4. Anchor vertical leg of flashing into backing with a termination bar and sealant.
 - 5. Apply cap bead of sealant on top edge of self-adhered flashing.
- D. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- E. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.

- F. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
- G. Support flexible flashings across gaps and openings.
- H. Extend laminated flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
- I. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

- A. Install precast concrete lintels over openings as indicated.
- B. Install loose steel lintels or formed-in-place masonry lintels where shown and indicated and where openings of more than 12 inches for brick size units and 24 inches for block size units are shown without structural steel or other supporting lintels. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
 - 1. Provide loose steel lintels unless otherwise indicated.
 - 2. Provide formed-in-place masonry lintels for openings in fire rated masonry walls and masonry walls in damp, wet, or exterior locations.
- C. Maintain minimum 8 inches of bearing on each side of opening.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.
- C. Locate control joints and expansion joints per drawings. Where joints are not specifically indicated on drawings locate joints to comply with NCMA TEK 10-02D. Location of control and expansion joints shall be indicated on shop drawings and approved by architect prior to the start of masonry installation.
- D. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- E. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- F. Form expansion joint as detailed on drawings.

3.13 BUILT-IN WORK

- A. As work progresses, build in items as specified in this and other Sections. Fill in solidly with masonry around built-in items.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

- D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- E. Fill cores in hollow CMUs with grout 24 inches
- F. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.15 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense. Perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Inspections: Special inspections to comply with International Building Code.
 - 1. Begin masonry construction only after inspectors have verified proportions of prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of prepared grout.
- C. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.
- D. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- E. Mortar Tests: Test each type of mortar in accordance with ASTM C780.
 - 1. Prior to Construction: One set of tests.
 - 2. Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

3.17 REPAIRING, REPOINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-progress cleaning: Clean unit masonry as work progresses by dry brush to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample panel or mock-up assembly; leave one half of panel uncleaned for comparison purposes.
 - 3. Protect adjacent surfaces from contact with cleaner.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.18 PROTECTION

- A. Stain Prevention: Prevent construction materials and soil from staining the face of masonry to be left exposed or painted. Immediately remove all deleterious and damaging/staining materials and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud by spreading coverings on ground and over wall surface.
- B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

3.19 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste.
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2000

SECTION 05 1200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

- A. Details and fabrication of structural steel shall conform to the following publications.
- B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
 - 1. AISC M013 Detailing for Steel Construction
 - 2. AISC M016 ASD Manual of Steel Construction
 - AISC S335 Structural Steel Buildings Allowable Stress Design and Plastic Design
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - 1. ASTM A36/A36M Carbon Structural Steel
 - 2. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - 3. ASTM A123/A123M Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A153/A153M Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 5. ASTM A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 6. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 7. ASTM A563 Carbon and Alloy Steel Nuts
 - 8. ASTM A780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - ASTM A992/A992M Steel for Structural Shapes for Use in Building Framing
 - 9. ASTM C827 Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
 - 10. ASTM C1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 11. ASTM F436 Hardened Steel Washers
 - 12. ASTM F844 Washers, Steel, Plain (Flat), Unhardened for General Use
 - ASTM F959 Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
 - 13. ASTM F1554 Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- D. AMERICAN WELDING SOCIETY, INC. (AWS)
 - 1. AWS D1.1 Structural Welding Code – Steel
- E. STEEL STRUCTURES PAINTING COUNCIL (SSPC)
 - 1. SSPC SP 3 Power Tool Cleaning

2. SSPC SP 6 Commercial Blast Cleaning
3. SSPC Paint 25 Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
4. SSPC PA 1 Shop, Field, and Maintenance Painting

1.3 SUMMARY

A. Section Includes:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Grout.

B. Related Sections:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Steel Deck" for field installation of shear connectors.
3. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.

1.4 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.5 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
 2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
- B. Construction: Combined system of moment frame, braced frame, and shear walls.
- C. Moment Connections: Type FR, fully restrained.

1.6 ACTION SUBMITTALS

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

- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
 - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Erection Plan.
 - 1. Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.
- D. Welding certificates.
- E. Qualification Data: For testing agency.
- F. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Shear stud connectors.
 - 4. Load indicator washers.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- G. Source quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
 - 1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
 - a. Category: Category I, conventional steel structures.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M, Grade 50.
- B. Channels, Angles: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: Standard.
 - 2. Finish: Black.
- F. Welding Electrodes and Rods: Comply with AWS D1.1 requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: as indicated.
 - 2. Nuts: ASTM A 563 hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 hardened carbon steel.
 - 5. Finish: Plain.
- D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain.
- E. Load Indicator Washers: ASTM F959.

2.3 SHOP PRIMER

- A. SSPC Paint 25 epoxy-polyamide, green primer (Form 150) type 1. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.4 GALVANIZING

- A. ASTM A123 or ASTM A153, as applicable, unless specified otherwise, galvanize after fabrication where practicable.

2.5 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; capable of developing a minimum compressive strength of 8,000 psi in 28 days.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 1. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 2. Mark and match-mark materials for field assembly.
 - 3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (U.N.O.)
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened (U.N.O.).
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Shop prime structural steel, except as modified herein, in accordance with SSPC PA
 - 2. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, surfaces to receive epoxy coatings, surfaces designed as part of a composite steel concrete section, or surfaces within 0.5 inch of the toe of the welds prior to welding, except surfaces on which metal decking is to be welded. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Engineer.
- B. Surface Preparation: Clean surfaces to be painted. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, mill scale, spatter, slag, flux, dirt, oil, grease, and other contaminants through final assembly.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces. Repair damaged primed surfaces with an additional coat of primer.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.
 3. All structural steel, bolts, connectors and fasteners exposed to moisture shall be galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base, Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened (U.N.O.).
- A. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect the erected steel in the field. This inspection shall also include alignment, position of member, welds and high-strength bolted connections, painting, etc. The inspection agency shall also submit to the Structural Engineer certified reports showing results of these inspections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 1. Should deficiencies in welds be noted by visual inspection then field welds may be tested according to AWS D1.1 and the following inspection procedures, at Owner's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 2. In addition to the visual inspection as indicated above, ultrasonic testing of all groove welds which are in tension and 25% of all groove welds which are in compression shall be required. The testing shall be done using "Branson" ultrasonic testing equipment, or other approved non-destructive testing systems. If faulty welds are discovered by this testing, costs of repair and any additional tests shall be borne by the Contractor.
- D. Should visual inspection identify deficiencies in welded shear connectors, then field-welded shear connectors may be tested according to requirements in AWS D1.1 for stud welding at Owner's option as follows:
 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- F. Submit certified field reports, indicating that the steel, including corrected deficiencies as erected meets all of the requirements of the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 3.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

END OF SECTION

SECTION 05 3100 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite floor deck.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
 - 2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
 - 3. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 9 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- D. Product Certificates: For each type of steel deck, signed by product manufacturer.
- E. Welding certificates.
- F. Field quality-control test and inspection reports.

- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- H. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from same manufacturer.
- C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- F. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
- G. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- H. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.; The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.
 - l. Valley Joist; Division of EBSCO Industries, Inc.
 - m. Verco Manufacturing Co.
 - n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G60 (Z180) zinc coating.
 - 2. Deck Profile: As indicated
 - 3. Profile Depth: As indicated
 - 4. Span Condition: As indicated
 - 5. Side Laps: Overlapped

2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 (Z180) zinc coating.
 - 2. Profile Depth: As indicated.
 - 3. Design Uncoated-Steel Thickness: As indicated.
 - 4. Span Condition: As indicated.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work as follows (U.N.O.):
 - 1. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0598 inch thick steel sheet painted or galvanized to match deck opening at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

- J. Shear Connections: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
1. Weld Diameter: 5/8 inch (16 mm), nominal (U.N.O.).
 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support (U.N.O.). Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter (U.N.O.), based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 24 inches (U.N.O.), and as follows:
1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 3/4 inch nominal.
 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart.
 3. Weld Spacing: Space and locate welds as indicated.
 4. Weld Washers: Install weld washers at each weld location.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds and fasteners will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- F. Submit certified field reports, indicating that the steel deck, including corrected deficiencies as erected meets all of the requirements of the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

- 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9 .
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DOCUMENT 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Load-bearing wall framing.
 - 2. Exterior non-load-bearing wall framing.
 - 3. Interior non-load bearing wall and soffit / ceiling framing
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Delegated-Design Submittal: For cold-formed steel framing.
- C. Shop Drawings: Submit placement drawings for framing members showing size and gage designations, number, type, locations, and spacing. Indicate reinforced channels, opening framing, supplemental strapping, bracing, bridging, splices, connection details, accessories and details required for proper installation. Shop Drawings shall be signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by the light gauge metal framing contractor.
 - 1. Include fully dimensioned and detailed drawings of special components not covered by Product Data.
 - 2. Submittal to include complete design calculations signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by the light gauge metal framing contractor.

- D. Stud sizes and details shown on Drawings indicate general installation and connection methods. Complete design and detailing of all components for all loads and forces is to be shown on the Shop Drawings. Design of all conditions not detailed on the Drawings shall be provided by a registered Professional Engineer, licensed in the State in which project is located and employed by the light gauge metal framing contractor. No changes from sizes and installation methods shown will be permitted without the express written consent of the Architect and the Structural Engineer.
- E. Welding certificates.
- F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- G. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load / Non-Load Bearing Wall Framing: Steel framing / studs shall be of a configuration and gage to provide sufficient stiffness, as controlled by the maximum allowable horizontal deflection, under full live load, dead load and wind load of $1/600$ of the wall height when secured to masonry veneer and $1/360$ in all other areas.
 - b. Interior Load / Non-Load Bearing Wall Framing: Steel framing / studs shall be of a configuration and gage to provide sufficient stiffness, as controlled by the maximum allowable horizontal deflection of $L/360$ of the wall height under a horizontal load of 5 lbf/sq. ft. in all areas (U.N.O.).
 - c. Shear Wall Framing: Steel framing / studs / strapping / connections shall be of a configuration and gage to provide sufficient stiffness and strength to support loads as indicated. Maximum allowable story drift shall not exceed $H/500$.
 - d. Soffit / Ceiling Framing: Vertical deflection of $1/360$ of the horizontally projected span for live load and $1/240$ for total loads in all areas.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
 - 5. Steel framing / studs secured to masonry veneer shall be minimum 18 gauge with maximum spacing not to exceed 16 inches on center.
 - 6. Design exterior load / non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.

- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness Matching steel studs.
 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for one-story structures.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Flange Width: 1 inch plus the design gap for one-story structures.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.

6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

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

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

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

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
 - H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
 - I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.
 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
 - J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
 - K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
 - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: As indicated.
 - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
 - D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 4. Connect drift clips to cold-formed metal framing and anchor to building structure.

- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Submit certified field reports, indicating that the metal framing, including corrected deficiencies as erected meets all of the requirements of the Contract Documents.

3.7 REPAIRS AND PROTECTION

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

END OF DOCUMENT

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for countertops.
 - a. Concealed Flat Brackets
 - b. Semi-Concealed Brackets
 - c. Exposed Brackets
 - d. ADA Brackets
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 4. Metal Ladders
 - 5. Slotted channel framing.
 - 6. 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 3300 "Cast-In-Place Concrete"
 - 2. Section 04 2000 "Unit Masonry" and/or 04 2200 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Section 06 1053 "Miscellaneous Rough Carpentry"

1.2 REFERENCE STANDARDS

- A. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
- B. ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts; and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
- C. ASME B18.6.1 - Wood Screws (Inch Series).
- D. ASME B18.21.1 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).
- E. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application.

- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- G. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- J. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- K. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- L. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- M. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- N. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- O. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- P. ASTM B632/B632M - Standard Specification for Aluminum-Alloy Rolled Tread Plate.
- Q. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- R. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- S. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- T. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.
- U. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- V. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- W. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- X. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.
- Y. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- Z. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- AA. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

- BB. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel.
- CC. MFMA-4 - Metal Framing Standards Publication.
- DD. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.
- EE. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- FF. SSPC-SP 3 - Power Tool Cleaning.
- GG. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning.
- HH. SSPC-SP 16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Fasteners.
 - 2. Shop primers.
 - 3. Shrinkage-resisting grout.
 - 4. Manufactured metal ladders
 - 5. Slotted channel framing.
 - 6. Counter and Shelf Brackets.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 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. Metal ladder.
- C. Templates/Template Drawings: Provide for anchors and bolts specified for installation under other sections.

- D. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3, "Structural Welding Code - Sheet Steel"
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer registered in the jurisdiction of the project to design components and connections of architectural elements including, but not limited to, guardrails, handrails, metal stairs, ladders, and other miscellaneous appurtenances as indicated in the Contract Documents. Submit to the Architect/Engineer, for review, signed and sealed shop drawings prepared by the contractor's engineer.
- B. 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. Base engineering calculations on surface temperature of materials due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- C. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC 14.3.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. 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.
 - 2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
- F. Aluminum Extrusions: ASTM B221 (((ASTM B221M))), Alloy 6063-T6.
- G. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
 - 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
- I. Machine Screws: ASME B18.6.3
- J. Lag Bolts: ASME B18.2.1
- K. Wood Screws: Flat Head ASME B18.6.1
- L. Plain Washers: Round, ASME B18.2.2.1
- M. Lock Washers: Helical, spring type, ASME B18.21.1
- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) 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 B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting," Section 09 9123 "Interior Painting," and Section 09 9600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 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 (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
- E. Galvanize miscellaneous framing and supports where indicated.
- F. Prime miscellaneous framing and supports with primer specified in Section 09 9600 "High-Performance Coatings" where indicated.

2.7 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3.
- B. Aluminum Ladders:
 1. Basis of Design Product: Subject to compliance with requirements, provide O'Keefe's, Inc. Tubular Rail Low Parapet Access Ladder with Walk Through Rail Extension; Model 504 or comparable product by another manufacturer.
 2. Source Limitations: Obtain aluminum ladders from a single source from a single manufacturer.
 3. Space Siderails: 24 inches apart unless otherwise indicated.
 4. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inches wide, and 1/8 inch thick.
 5. Rungs: Extruded aluminum tubes, not less than 3/4 inches deep and not less than 1/8 inch thick, with ribbed or serrated tread surfaces.
 6. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets.
 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets.

2.8 SUPPORTS FOR COUNTERTOPS/SHELVES

- A. General:
 1. Basis of Design Product(s) and Manufacturer: Subject to compliance with requirements provide the following product(s) as manufactured by A&M Hardware or comparable product(s) by another manufacturer.
 2. Size: Counter brackets shall be sized as recommended by product manufacturer to accommodate counter/shelf depth, thickness, and loading. Brackets shall not extend beyond 1 inch from face of counter/shelf unless required to accommodate shelf loading or specific bracket requirements.
 3. Spacing:
 - a. Where attached to wood or metal studs Brackets shall not be spaced more than 48 inches apart or every other stud, whichever is less.
 - b. Where attached to flat surfaces, brackets shall be spaced no more than 32 inches apart.
 4. Where brackets are not symmetrical provide right and left handed brackets for flush finished exposed surface.

- B. Concealed Counter Support Brackets:
 - 1. Basis of Design Product: Concealed Flat Brackets model C or CE.
 - a. Shelving: 1.0 inch width
 - b. Counters: 2.0 inch width
 - 2. Flat bracket with vertical extension, Model CE, shall be provided where wall studs or surface extend vertically above counter/shelf with sufficient height to accommodate vertical bracket extension without interfering with other Work.
 - 3. Flat bracket without vertical extension, Model C, shall be provided where a vertical extension bracket cannot be utilized.
 - 4. Arm Lengths:
 - a. 1 inch Bracket: 9, 12, 15, & 18 inches.
 - b. 2 inch Bracket: 9, 12, 18, 21, & 24 inches
 - 5. Material: Steel
 - 6. Color: Black unless otherwise noted.
- C. Semi-Concealed Brackets:
 - 1. Basis of Design Product: Concealed Workstation Brackets model C or CE.
 - a. Shelving or Counters 18 inches or less in depth: 1.0 inch
 - b. Counters over 18 inches in depth: 2.0 inch
 - 2. Semi-concealed brackets with vertical extension, Model CE, shall be provided where wall studs or attachment surface extend vertically above counter/shelf with sufficient height to accommodate vertical bracket extension without interfering with other Work.
 - 3. Semi-concealed brackets without vertical extension, Model C, shall be provided where vertical bracket cannot be utilized..
 - 4. Arm Length:
 - a. 1.0 inch Bracket: 9, 12, 15, & 18 inches
 - b. 2.0 inch Bracket: 9, 12, 15, 18, 21, 24, & 30 inches
 - 5. Material: Steel
 - 6. Color: Black unless noted otherwise.
- D. Exposed Brackets:
 - 1. Basis of Design: Standard Workstation and Countertop Bracket.
 - 2. Size:
 - a. 18 inch Deep Counter/Workstation: Model 12 x 18
 - b. 21 inch Deep Counter/Workstation: Model 21 x 21
 - c. 24 inch Deep Counter/Workstation: Model 24 x 24
 - d. 30 inch Deep Counter/Workstation: Model 24 x 29
 - 3. Material: Steel
 - 4. Finish: As selected by Architect from manufacturer's full range.
- E. ADA Support Bracket
 - 1. Basis of Design Product: ADA Vanity Bracket.
 - 2. Depth: Provide 21 inch depth or 23 inch depth bracket to accommodate counter as indicated within drawings.
 - 3. Material: 12 gauge steel.
 - 4. Finish:
 - a. Where sides are exposed, Architect shall select finish from manufacturer's full range.

- b. Where sides are indicated to receive finished panel, provide primed finish.
- c. Where sides are indicated to receive coating/paint finish, provide primed finish.
- 5. Panel Attachment Hardware/Preparation:
 - a. Provide skirt panel attachment clips.
 - b. Where brackets are indicated to receive side panels, prepare brackets with side panel attachment holes and hardware.

F. Standards and Brackets:

- 1. Basis of Design Product: Subject to compliance with requirements. provide Knappe & Vogt 85 Series Standards and 185 Series Brackets or comparable product by another manufacturer.
- 2. Standard Length: 60 inches
- 3. Standard Dimensions: 1-1/4 x 1/2 inches
- 4. Standard Thickness: 16 Ga.
- 5. Bracket Size: 12 inches
- 6. Bracket Thickness: 16 Ga.
- 7. Vertical Adjustment: 1 inch increments
- 8. Slot: Double Slot Design
- 9. Capacity: 680 lbs/pair
- 10. Finish: Manufacturer's standard Chrome/anochrome finish.

2.9 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 bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.10 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 and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with primer specified in Section 09 9600 "High-Performance Coatings."

2.11 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.

2.12 GENERAL FINISH REQUIREMENTS

- 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.

2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M 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 galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 09 9113 "Exterior Painting" unless primers specified in Section 09 9600 "High-Performance Coatings" are 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 09 9600 "High-Performance Coatings": SSPC-SP 6/NACE No.3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- 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.

2.14 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. 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.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLATION OF 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 shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

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SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preservative treated wood materials.
- B. Fire retardant treated wood materials.
- C. Plywood mounting boards (backing panels.)
- D. Concealed wood blocking, nailers, and supports.
- E. Miscellaneous wood nailers, furring, and grounds.
- F. Miscellaneous wood sheathing; Wall and roof.

1.2 RELATED REQUIREMENTS

- A. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- E. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
- F. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry.
- I. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- J. AWPA U1 - Use Category System: User Specification for Treated Wood.
- K. PS 1 - Structural Plywood.

- L. PS 20 - American Softwood Lumber Standard.

1.4 DEFINITIONS

- A. Boards and Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimensional Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data for wood preservative materials, fire-retardant treatment, and application instructions from chemical treatment manufacturer and certification by treatment plant that treatment materials comply with requirements. Indicate type of treatment used and net amount of treatment retained.
 - 1. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by qualified independent testing agency according to ASTM D5664.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species:
 - a. Spruce-Pine-Fir (South)
 - b. Hem-Fir (North)
 - c. Douglas Fir (South)
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
 5. Factory mark each piece of lumber with grade stamp of grading agency.
 6. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.
- C. Lumber fabricated from recovered timber is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.2 DIMENSION LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including but not limited to blocking, nailers, grounds, furring, sleepers, plates, cants, and curbs.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: Kiln-dry or MC15.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, Sleeper, Plates Cants, Curbs, and Furring:
1. Lumber: S4S, No.2 or Standard Grade.
 2. Boards and Strips: Standard or No.3.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For rurring strips fo rinstalling plywood or hardboard paneling , select boards with no knots capable of producing bent-over nails and damage to paneling.

2.3 CONSTRUCTION PANELS

- A. Plywood Mounting Boards (Backing Panels): PS 1, A-C plywood; 3/4 inch thick; fire-retardant treated; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

- A. Fasteners and Anchors, General: Provide faseners of size and type that comply with requirements specified in this article for material and manufacture.
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Nails, Brads, and Staples: ASTM F1667/F1667M.
- C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.
 1. Screw length shall be of sufficient length to penetrate and secure multiple plies to metal framing and not be secured by previous ply or substrate.
- D. Power Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
- F. Metal Framing Anchors
 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. Cleveland Steel Specialty Co.
 - b. KC Metal Products, Inc.
 - c. Phoenix Metal Products, Inc.
 - d. Simpson Strong-Tie Co., Inc.
 - e. USP Structural Connectors.
 2. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - a. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
 - 3.
- G. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.

2.5 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Fire Retardant Treatment:
 1. Application: Treat miscellaneous carpentry only where indicated and as follows:

- a. Exterior Type: AWP A U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - 1) Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - 2) Do not use treated wood in direct contact with ground.
 - b. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature, low hygroscopic type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - 1) Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - 2) Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
- 1. Application: Treat all miscellaneous carpentry unless otherwise indicated.
 - a. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A.
 - 1) Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 2) Treat lumber exposed to weather.
 - 3) Treat lumber in connection with roofing, flashing, or waterproofing.
 - 4) Treat lumber in contact with masonry or concrete.
 - 5) Treat lumber less than 18 inches above grade.
 - 6) Treat lumber in other locations as indicated.
 - b. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F.
 - 1) Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - 2) Treat plywood in connection with roofing, flashing, or waterproofing.
 - 3) Treat plywood in contact with masonry or concrete.
 - 4) Treat plywood less than 18 inches above grade.
 - 5) Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Set Carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailing blocking and similar supports to comply with requirements for attaching other construction.
- B. Select material sizes to minimize waste.
- C. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

- D. Do not splice structural members between supports unless otherwise indicated.
- E. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- F. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1 "Fastening Schedule" in ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- I. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.2 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches on center.
- C. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- D. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- E. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- F. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.3 INSTALLATION OF CONSTRUCTION PANELS

- A. Plywood Mounting Boards (Backing Panels): Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

- 4. Size and Location: As indicated on drawings.

3.4 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.5 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 1053

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SECTION 06 1600 - SHEATHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sheathing; Wall.

1.2 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry or 06 1053 - Miscellaneous Rough Carpentry; Wood framing blocking, nailers, and other similar miscellaneous items.
- B. Section 07 2500 - Weather Barriers.
- C. Section 07 2600 - Vapor Retarders.
- D. Section 07 2700 - Air Barriers.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- E. ASTM C1185 - Standard Test Methods for Sampling and Testing Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.
- F. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- G. ASTM D1293 - Standard Test Methods for pH of Water.
- H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on sheathing(s) and application instructions; including joint and penetration treatment materials.

- C. Certificate: Certify that products of this section meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum three years of documented experience.
- B. Testing Agency Qualifications:
 - 1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store products above ground in dry ventilated space to protect against moisture. Support stacked products to prevent deformation and allow air circulation.
- C. Protect sheathing from weather by covering with water proof sheeting, securely anchored. Provide air circulation under coverings.
- D. Store panels over stable soil capable of carrying load of pallets.
- E. Protect materials from soiling and damage.
- F. Deliver materials to site promptly without undue exposure to weather.
- G. Deliver in manufacturer's unopened containers, pallets, or panels fully identified with name, brand, type, and grade.
- H. Do not stack panels over plus or minus 1/2 inch off pallet edge.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 SHEATHING

- A. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M.
 - 1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Thickness: As indicated within Drawings.
 - 4. Edges: Square.

5. Basis of Design Product: Subject to compliance with requirements, provide one of the following products.
 - a. CertainTeed Corporation; GlasRoc Brand: www.certainteed.com/#sle.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com/#sle.
 - d. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing: www.usg.com/#sle.

2.3 ACCESSORIES

- A. Fasteners and Anchors:
 1. General: Refer to manufacturer product information for fastener types and requirements.
 2. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 3. Gypsum Board Screws: ASTM C1002; Type W, bugle head, self-piercing, tapping screws; length to penetrate wood members 5/8 inch minimum.
 4. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Panel Treatment: Use manufacturer-recommended sealant, transition trips, flashing sheets, termination bars, patching materials, and adhesive tapes at control joints, panel connections, and penetrations.
- C. Sealants:
 1. Medium-modulus, low-VOC, polyurethane for use in joints, penetrations, and transition areas.
- D. Transition Membrane: Silicone extrusion for expansion joints between panels.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof and floor framing meet deflection criteria noted in drawings, as recommended by manufacturer and local building code requirements.
- B. Examine substrates and adjoining construction.
- C. Replace damaged framing before installation of cementitious panel subfloor. Proceed with installation only after unsatisfactory conditions corrected.

3.2 PREPARATION

- A. Coordinate installation of roof and floor deck construction, framing of openings, and other assembly installation.
- B. Coordinate installation of rough carpentry members specified in other sections.

3.3 INSTALLATION OF CONSTRUCTION PANELS

- A. Select material sizes to minimize waste.

- B. Reuse and clearly separate scrap for use on-site as accessory components, including shims, bracing, and blocking.
- C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

3.4 TOLERANCES

- A. Surface Flatness of Floor: 1/8 inch in 10 feet, maximum, and 1/4 inch in 30 feet, maximum.
- B. Variation from Plane; Surfaces Other Than Floors: 1/4 inch in 10 feet, maximum, and 1/4 inch in 30 feet, maximum.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
 - 1. Provide testing and inspection required by ABAA QAP.
 - 2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
 - 3. Cooperate with ABAA testing agency.
 - 4. Allow access to air barrier work areas and staging.
 - 5. Do not cover air barrier work until tested, inspected, and accepted.

3.6 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn pressure treated scraps.
- B. Clean material debris, shavings, and sawdust prior to Substantial Completion of project.

3.7 PROTECTION

- A. Do not permit traffic over unprotected floor surface.
- B. Cover sheathing panels by exterior cladding or other weather-resistive barrier. Do not expose panels to elements for more than 12 months after installation. If exposure anticipated past 12 months, apply joint treatments, weather-resistive barrier, or air barrier according to manufacturer's recommendations.

END OF SECTION 06 1600

SECTION 06 6400 - PLASTIC PANELING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic sheet paneling.
 - a. Fiber Reinforced Plastic Paneling

1.2 REFERENCE STANDARDS

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic paneling and trim accessories from a single manufacturer for each separate plastic paneling product.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling FRP-1: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Composites, Inc.
 - b. Glasteel.
 - c. Marlite.
2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
3. Nominal Thickness: Not less than 0.12 inch.
4. Surface Finish: Molded pebble texture.
5. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Fiber Reinforced Plastic Paneling Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 1. Color: Match panels.
- B. Adhesive: As recommended by plastic paneling manufacturer.
- C. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION, FIBER REINFORCED PLASTIC PANELS

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 6400

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SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, emulsified-asphalt dampproofing.

1.2 ACTION SUBMITTALS

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

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- 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. APOC, Inc; a division of Gardner Industries.
 - 2. BASF Corporation; Construction Systems.
 - 3. Brewer Company (The).
 - 4. ChemMasters, Inc.
 - 5. Euclid Chemical Company (The); an RPM company.
 - 6. Henry Company.
 - 7. Karnak Corporation.
 - 8. Mar-flex Waterproofing & Building Products.
 - 9. W. R. Meadows, Inc.
- B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668/D 1668M, Type I.

- D. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Thickness: Nominal 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 1/4 inch (6 mm) onto shelf angles supporting veneer.
- D. Where dampproofing interior face of above-grade, exterior walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m).
- B. Unparged Masonry Foundation Walls: Apply primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m).
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).

- E. Exterior Face of Inner Wythe of Below Grade Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.3 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

END OF SECTION 07 1113

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SECTION 07 1900 - WATER REPELLENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes clear film-forming water-repellent treatments for the following vertical and non-traffic horizontal surfaces:
 - 1. Cast stone.
 - 2. Concrete unit masonry.
- B. Related Sections:
 - 1. Section 04 20 00 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.
 - 1. Cast-in Place Concrete: ASTM C 642.
 - 2. Precast Concrete: ASTM C 642.
 - 3. Cast Stone: ASTM C 1195.
 - 4. Concrete Masonry Units: ASTM C 140.
 - 5. Clay Brick: ASTM C 67.
 - 6. Natural Stone: ASTM C 97.
 - 7. Portland Cement Plaster (Stucco): ASTM D 6532.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Installed water repellents shall comply with performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard substrate assemblies by a qualified testing agency.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard colors.
 - 3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

4. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

- B. Samples: For each type and color of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of water repellent, from manufacturer.
- B. Warranty: Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

- A. Mockups: Apply water repellent to each type of substrate required.
 1. Locate each test application as directed by Architect.
 2. Size: 10 sq. ft. (9.3 sq. m).
 3. Final approval by Architect of water-repellent application will be from test applications.

1.8 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 1. Concrete surfaces and mortar have cured for not less than 28 days.
 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
 5. Rain or snow is not predicted within 24 hours.
 6. Not less than 24 hours have passed since surfaces were last wet.
 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Applicator agree(s) to repair or replace materials that fail to maintain water repellency due to materials and/or workmanship as specified within specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrates, and new substrate cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of one or several different resins (silanes or siloxanes or acrylics), polymers, stearates, or oils plus other compounds or products of components; and with 400 g/L or less of VOCs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals, LLC; Enviroseal 20.
 - b. PROSOCO, Inc.; Weatherseal H40.
 - c. Diedrich Technologies inc.; Diedrich 303 WB
 - d. Sonneborn Building Products; White Roc 10 WB
 - e. Euclid Chemical; Chemstop WB Heavy Duty
 - f. Diedrich Technologies, Inc.; Diedrich 303
 - g. Harris Specialty Chemicals, Inc. Enviroseal Silane 20.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
 - 1. Cast-in-Place Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents .
- B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

- C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- (103 kPa-) pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

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

END OF SECTION 07 1900

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SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Mineral-wool blanket insulation; Batt insulation for walls and roofs and Acoustic batt insulation.
 - 2. Mineral-wool board insulation.
- B. Related Requirements:
 - 1. Section 04 2000 "Unit Masonry" for insulation installed in masonry cells.
 - 2. Section 09 2900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Mineral-wool blanket insulation.
 - 2. Mineral-wool board insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced : ASTM C665, Type IA (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.2 MINERAL-WOOL BOARD INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Mineral Wool Board Insulation, Type IVB Faced Exterior Insulation for Rain Screen Applications: ASTM C612, Type IVB; faced on one side with a black mineral fleece facing.
 1. Basis of Design Product: Subject to compliance with requirements, provide Cavityrock as manufactured by Rockwool or comparable product by another manufacturer.
 - a. Monolithic Density: 4.3 lb/cu. ft.
 - b. Density: 6.2 lb/ cu. ft.
 - c. Flame Spread Index: Not more than 15 when tested in accordance with ASTM E84
 - d. Smoke Developed Index: Not more than zero when tested in accordance with ASTM E84
 - e. Labeling: Provide identification of mark indicating R value of each piece of insulation 12 inches and wider in width.

2.3 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 - 7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
 - b. Interior Walls: Set units with facing placed as indicated on Drawings toward areas of high humidity.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 07 2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- B. ASTM D4263 - Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method.
- C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- E. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.4 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
 - 1. Build integrated mockups of exterior wall assembly , 150 sq. ft. (14 sq. m), incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

- B. Protect stored materials from direct sunlight.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.0002 cfm/sq. ft. of surface area at 75 Pa, when tested according to ASTM E2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.03 inch) over smooth, void-free substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 3M Industrial Adhesives and Tapes Division; 3M Liquid Air Barrier 2085VP.
 - b. DuPont Building Innovations: E. I. du Pont de Nemours and Company; DuPont Tyvek Fluid Applied WB.
 - c. Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
 - d. Sto Corp; StoGuard AirSeal.
 - e. TK Products; TK-Airmax 2104 Vapor Permeable.
 - f. W.R. Meadows, Inc; Air-Shield LMP.
 - 2. Physical and Performance Properties:
 - a. Vapor Permeance: Minimum 22 perms; ASTM E96/E96M, Desiccant Method, Procedure A.
 - b. Ultimate Elongation: Minimum 320 percent; ASTM D412, Die C.
 - c. Adhesion to Substrate: Minimum 25 lbf/sq in when tested according to ASTM D4541.
 - d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier 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 in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 2726

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SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- A. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- D. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- E. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus.
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- H. FM 4991 - Approval Standard of Firestop Contractors.
- I. ITS (DIR) - Directory of Listed Products.
- J. SCAQMD 1168 - Adhesive and Sealant Applications.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- L. UL 1479 - Standard for Fire Tests of Penetration Firestops.
- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Penetrations through fire-resistance rated construction, including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrations.
 - 2. Expansion and control joints in fire rated walls, floors, floor-ceiling and roof-ceiling assemblies.
 - 3. Voids at the intersections of fire rated walls, floors, floor-ceilings, and roof-ceiling assemblies.
 - 4. Intersections and penetrations of floors, ceilings, walls and columns.
 - 5. Firestopping penetrations, created under Work of this project in fire-resistance rated construction at existing buildings.

1.4 REFERENCES

- A. The following publications govern the work of this Section and are hereby incorporated in the Contact Documents as if bound herein. The Standards described apply generally unless specifically indicated otherwise in the text. They are identified below by their publishers and are referred to in the text by basic designation only.
1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - a. ASTM E84-91 a Surface Burning Characteristics of Building Materials
 - b. ASTM C1193-91 Guide for Use of Joint Sealants
 - c. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2012
 - d. ASTM E814 - Standard Test Method for Fire Test Method for Fire Tests of Penetration Firestop Systems.
 - e. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011)
 - f. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2010
 - g. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymer materials to Fungi; 2009
 2. UNDERWRITERS LABORATORIES (UL)
 - a. UL-05 Fire Resistance Directory
 - b. UL 723 - Test for Surface Burning Characteristics of Building Materials
 - c. UL 1479 - Fire Tests of Through Penetration Firestops
 - d. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; 2004
 3. OTHER TESTING SERVICES AND AGENCIES
 - a. ITS (DIR)- Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition
 - b. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001
 - c. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
 - d. SCAQMD 1168 - South Coast Air Quality management District Rule No. 1168; current edition

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Manufacturer's descriptive data, installation instructions and fire-test data and/or report as appropriate for the fire resistance rated construction and location.
 2. Submittal shall indicate the firestopping material to be provided with each type of application.
- B. Shop Drawings
1. Show illustration details as appropriate for the fire resistance rated construction and locations required. When more than five (5) penetrations are to receive firestopping, drawings shall indicate location and type of application.
 2. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 3. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.6 INFORMATIONAL SUBMITTALS

- A. Certificates: Certificates attesting that firestopping material complies with the specific requirements. The label of listing of the Underwriters laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing.
- B. Qualification Data: For Installer.
 - 1. Manufacturer's certification stating that each installer is qualified and trained to install the specified requirements and testing.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.9 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
 - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. If acceptable, mock-up will represent the minimum standard for the Work.
- C. If accepted, mock-up may remain as part of the Work.

1.10 SYSTEM DESCRIPTION

- A. Firestopping shall consist of furnishing and installing a material or combination of materials to form an effective barrier against the spread of flame, smoke, and gases, and maintain the integrity of fire resistance rated walls, barriers, partitions, floors, floor/ceiling/roof assemblies. including through penetrations and construction joints. Through penetrations include the annular spaces around pipes, tube, conduits, wire, cables, and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping materials shall not interfere with required movement of joints.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.12 STORAGE AND DELIVERY

- A. Materials shall be delivered in the original un-opened packages or containers showing names of the manufacturer and the brand name of the product. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.13 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS, GENERAL

- A. Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:
 - 1. Fire hazard Classification: Material shall have a flame spread of 25 or less, and a smoke development rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Materials shall be non-toxic to humans at all stages of the application and performance of the materials.
 - 2. Fire Resistance Rating: Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being installed within. Fire resistance ratings of construction joints as described in Part 1 Article "System Description" and gaps such as the construction in which they occur.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."

3) FM Approval in its "Approval Guide."

2.3 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Construction Solutions.
 - d. Grabber Construction Products.
 - e. Hilti, Inc.
 - f. HOLDRITE.
 - g. NUCO Inc.
 - h. Passive Fire Protection Partners.
 - i. RectorSeal.
 - j. Specified Technologies, Inc.
 - k. STC Sound Control.
 - l. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Fire resistance rated wall include fire walls, fire barriers, smoke barriers, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- a. ProVent Systems, Inc.

- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation
 - b. Sealants used in combination with other forming/damming/backing materials used to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board
 - d. Fillers for sealant.
 2. Temporary forming materials
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
1. Cast-In-Place Firestop Device for non-combustible and combustible pipes, conduits and cable bundles penetrating concrete floors:
 - a. Basis of Design Product: CP680P Cast in place firestop device as manufactured by Hilti, Inc. or comparable product by one of the following:
 - 1) Johns Mansville
 - 2) Nelson Firestop Products
 - 3) Specified Technologies Inc.
 - 4) 3M Fire Protection Product Division
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both conditions.

2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping 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 manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestoppings seal with substrates.

3.3 INSTALLATION

- A. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- B. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- C. Firestopping materials shall completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designated to support or shall be protected by barrier to prevent loading of traffic in the firestopped area. Firestopping shall be provided in the following locations:
 - 1. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire resistance rated walls, barriers, partitions, floors ceilings, and roof assemblies.
 - 2. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
 - 3. Gaps at the intersection of floor and curtain walls, including inside of hollow curtain walls at the floor slab.
 - 4. Construction joints in floors and fire rated walls and partitions.
 - 5. Gaps at perimeter of fire resistance rated walls, barriers, and partitions, such as between the top of walls and the bottom of roof decks.
 - 6. Other locations where required to maintain fire resistance rated construction.
- D. Penetrations made in existing building walls shall be sealed and firestopped the same day they are made. Existing holes within existing building walls abutting new construction or within areas of new construction uncovered by demolition procedures shall be sealed and firestopped.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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 - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 8413

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SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM C834 - Standard Specification for Latex Sealants.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
 - a. Control and expansion joints in unit masonry.
 - b. Joints between materials
 - c. Perimeter joints between materials and frames of doors and windows.
 - d. Other joints as indicated.
 - 2. Exterior and interior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion and isolation joints in cast-in-place concrete slabs.
 - b. Joints between different materials
 - c. Other joints as indicated
 - 3. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
 - a. Control, expansion joints on exposed interior surfaces of exterior walls
 - b. Perimeter joints of exterior openings where indicated.

- c. Joints between tops of non-load bearing unit masonry and concrete walls and partitions.
- d. Tile control and expansion joints
- e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
- f. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

B. Related Sections

- 1. 01 8113 "Sustainable Design Requirements" for LEED credits, submittal requirements, product data requirements.
- 2. Section 01 5731 "Indoor Air Quality (IAQ) Management" for VOC limits and other requirements.

1.4 DEFINITIONS

- A. Joint Sealants- caulk, caulking or joint sealers are synonymous and mean joint sealants as herein described.
- B. Exterior- joints at exterior surfaces of the building, whether or not directly exposed to the weather.
- C. Interior- joints at interior surfaces of the building but not exposed to the weather in any manner.
- D. Paving- Joints in floor slabs, sidewalks, steps, ramps, and curbs.

E. SYSTEM PERFORMANCE REQUIREMENTS

- 1. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- 2. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under environmental conditions replicating those that will exist during installation.
 - 2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.

2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
 1. Certification by joint sealant manufacturer that sealants manufacturer that sealants plus primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
 2. Certificates from the manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for use indicated.
- B. Material Safety Data Sheets: indicating that the VOC levels of the products provided under this Section do not exceed the specified allowable levels.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion Test Reports: For each sealant application tested.
- G. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.9 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees Fahrenheit.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors: Joint sealant colors shall be chosen by Architect from manufacturer's full range of colors. Multiple sealant colors may be chosen by Architect to achieve aesthetic value. Vertical or horizontal joints may consist of multiple sealant colors transitioning at differing materials.
- C. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. GE Advanced Materials - Silicones; UltraPruf II SCS2900.
 - c. Pecora Corporation; 895.
- B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. May National Associates, Inc.; Bondaflex Sil 728 NS.
 - c. Pecora Corporation; 311 NS.
 - d. Tremco Incorporated; Spectrem 800.
- C. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Corning Corporation; 786 Mildew Resistant.
- b. GE Advanced Materials - Silicones; Sanitary SCS1700.
- c. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Incorporated; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Remove laitance and form-release agents from concrete.
 - 3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 290 for use of latex sealants.

- D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.

- b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 - 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior and Interior joints in horizontal traffic surfaces.
- 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units, including steps.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
- 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.

- b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in exterior insulation and finish systems.
 - f. Joints between metal panels.
 - g. Joints between different materials listed above.
 - h. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - i. Control and expansion joints in ceilings and other overhead surfaces.
 - j. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
- 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - e. Other joints as indicated.
 - 2. Joint Sealant: Acrylic Latex or Siliconized Acrylic Latex.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
- 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
- 1. Joint Location:
 - a. Control and expansion joints on exposed interior surfaces of walls receiving acoustic sensitive materials/construction.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
 - c. Perimeter joints of walls and partitions between at ceilings and floors.
 - d. Acoustical joints where indicated.
 - 2. Joint Sealant: Acoustical.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 REFERENCE STANDARDS

- A. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- G. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- H. ASTM C476 - Standard Specification for Grout for Masonry.
- I. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- J. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.
- K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

- N. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.
- O. UL 9 - Standard for Fire Tests of Window Assemblies.
- P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM HMMA 861

1.5 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Curries Company; an Assa Abloy Group company.
 - 2. Pioneer Industries, Inc.
 - 3. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup to suit frame size, not less than 0.042 inch thick (2.01 inch) (10 inch); wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

- C. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.
- F. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.

- 2) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 2) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
 - E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 - F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
- 2.8 STEEL FINISHES
- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- 2.9 ACCESSORIES
- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM HMMA 840 as required by standards specified.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

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

- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 1113

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SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
- B. Related Sections:
 - 1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

1.3 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard.
- B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- C. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.01 inch in a 76.2-mm) span.
 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Algoma Hardwoods, Inc.
 2. Eggers Industries.
 3. Graham; an Assa A bloy Group company.
 4. Lambton Doors.
 5. Marshfield Door Systems, Inc.
 6. Mohawk Flush Doors, Inc.; a Masonite company.
 7. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- B. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
- C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors :
1. Grade: Premium, with Grade AA faces.
 2. Species: Select white birch
 3. Cut: Quarter sliced.
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Balance match.
 6. Pair and Set Match: Provide for doors hung in same opening.
 7. Exposed Vertical and Top Edges: Same species as faces.
 8. Core: Particleboard .
 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 LOUVERS AND LIGHT FRAMES

- A. Metal Louvers:
 - 1. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
- B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- D. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
- D. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: WDMA TR-6 catalyzed polyurethane.
 3. Effect: Filled finish.
 4. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 7100 "Door Hardware" and Section 08 7111 "Door Hardware (Descriptive Specification)."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

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SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames.
 - 2. Fire-rated access doors and frames.
- B. Related Requirements:
 - 1. Section 08 3113.53 "Security Access Doors and Frames" for access doors and frames for security applications.

1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- F. UL 10B - Standard for Fire Tests of Door Assemblies.

1.4 COORDINATION

- A. Each Prime Contractor is required to provide access panels to the General Contracting Prime Contractor for installation. It shall be the responsibility of each prime contractor to provide all access doors and frames required to access their concealed equipment, valves, controls and similar items requiring access and located behind finished surfaces. Each Prime Contractor shall determine specific location and sizes of access doors and frames required to gain access to concealed equipment, valves, controls, etc. and indicated on schedule under "ACTION SUBMITTALS" article of this Section.
 - 1. General Contractor shall coordinate the submission of the schedule of access doors and frames from each Prime Contractor for submission at same time.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames.
 - 1. Schedule shall indicate type of substrate, location, size, and latching/locking provisions for each access door and frame.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges :
 - 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. Acudor Products, Inc.
 - b. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; a division of Hart & Cooley, Inc.
 - g. Nystrom.
 - 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 3. Optional Features: Gasketing .
 - 4. Locations: Wall and ceiling.
 - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
 - 6. Frame Material: Same material, thickness, and finish as door.
 - 7. Latch and Lock: Latch bolt, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges :
 - 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. Acudor Products, Inc.
 - b. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; a division of Hart & Cooley, Inc.
 - g. Nystrom.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
 - 3. Optional Features: Gasketing.
 - 4. Locations: Wall and ceiling.
 - 5. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
 - 7. Frame Material: Same material, thickness, and finish as door.
 - 8. Latch and Lock: Self-latching door hardware, operated by key.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3113

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mechanical Hardware for wood, aluminum, and hollow metal doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Lock cylinders for doors that hardware is specified in other sections.
- E. Thresholds.
- F. Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.
- B. Section 08 1113 - Hollow Metal Doors and Frames.
- C. Section 08 1416 - Flush Wood Doors.
- D. Section 08 4313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.
- E. Section 28 1000 - Access Control: Electronic access control devices.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. BHMA (CPD) - Certified Products Directory.
- C. BHMA A156.1 - Standard for Butts and Hinges.
- D. BHMA A156.2 - Bored and Preassembled Locks and Latches.
- E. BHMA A156.3 - Exit Devices.
- F. BHMA A156.4 - Door Closers and Pivots.
- G. BHMA A156.5 - Cylinders and Input Devices for Locks.
- H. BHMA A156.6 - Standard for Architectural Door Trim.
- I. BHMA A156.7 - Template Hinge Dimensions.

- J. BHMA A156.16 - Standard for Auxiliary Hardware.
- K. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps.
- L. BHMA A156.21 - Thresholds.
- M. BHMA A156.22 - Standard for Gasketing.
- N. BHMA A156.26 - Standard for Continuous Hinges.
- O. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- P. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames.
- Q. DHI (H&S) - Sequence and Format for the Hardware Schedule.
- R. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- S. ITS (DIR) - Directory of Listed Products.
- T. NFPA 70 - National Electrical Code.
- U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- V. NFPA 101 - Life Safety Code.
- W. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- X. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- Y. UL (DIR) - Online Certifications Directory.
- Z. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- AA. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed within, installed on, or the operation of door hardware must interact with or affect. Coordinate all components with doors, frames, and related work to ensure proper size, thickness, handing, function, finish, and material requirements of door hardware.
 - a. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
 - 2. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
 - a. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
 - 3. Security: Coordinate installation of door hardware, keying, and access control with Owner's security representative.

4. Existing Openings/Doors: Where hardware components are scheduled for application to existing construction or where modifications to existing doors or door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 1. Architect.
 2. Installer's Architectural Hardware Consultant (AHC).
 3. Hardware Installer.
 4. Owner's Security Consultant and other Owner representatives as designated by Owner.
- C. Keying Requirements Meeting:
 1. Schedule meeting at project site prior to Contractor occupancy.
 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Architect.
 - d. Installer's Architectural Hardware Consultant (AHC).
 - e. Hardware Installer.
 - f. Owner's Security Consultant and other Owner representative .
 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - e. Establish delivery requirements for keys and cores.
 - 1) Confirm shipping sender; direct from manufacturer or care of contractor.
 - 2) Confirm shipping address and point of contact/receiver for keys/cores.
 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - d. Flow of traffic and extent of security required.
 5. Record minutes and distribute copies within two days after meeting to participants, with one digital copy to Architect, Owner, participants, and those affected by decisions made.
 6. Deliver established keying requirements to manufacturers.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Door Hardware Submittal Submission Sequence:
 1. Submit Door Hardware Product Data, Door Hardware Schedule, and Electrified Door Hardware shop drawings concurrently.

2. Coordinate submission of door hardware submittals with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule. Provide adequate time for initial submittal review as well as possible required re-submissions.
- C. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- D. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 2. Comply with DHI (H&S) using same scheduling sequence, door numbers and hardware set numbers as indicated in construction documents.
 - a. Submit in vertical format.
 3. List groups and suffixes in proper sequence.
 4. Provide complete description for each door and frame listed. Include identification number, location, handing, fire rating, and material.
 5. Provide locations of each door hardware set, cross-referenced to construction documents on floor plans and to door and frame schedule.
 6. For each hardware component within each hardware set, provide manufacturer name, product names, and catalog numbers; include quantities, functions, types, styles, sizes and finishes of each item.
 7. Provide mounting locations for each hardware component.
 8. Include account of abbreviations and symbols used in schedule.
- E. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Provide list of related door devices, automatic openers, access control system functions and components, security system functions and components, fire alarm system functions and components and other systems and components that are required to interact with each door. Where there are no related items, provide statement indicating that there are no related door devices or systems that interact with the door and its related hardware components.
 3. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 4. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- F. Samples for Verification:
1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.
 2. Submit one (1) sample of hinge, latchset, lockset, closer, and _____ illustrating style, color, and finish.
 3. Return full-size samples to Contractor.
 4. Submit product description with samples.

- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - 1. Submit manufacturer's parts lists and templates.
 - 2. Bitting List: List of combinations as furnished.
- I. Keying Schedule:
 - 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- J. Manufacturer's qualification statement.
- K. Installer's qualification statement.
- L. Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) qualification statement.
- M. Specimen warranty.
- N. Closeout Submittals
 - 1. Project Record Documents:
 - a. Record actual locations of concealed equipment, services, and conduit.
 - b. Final Door Hardware Schedule and Keying Schedule.
 - 2. Maintenance Data: For each type of door hardware to include in maintenance manuals.
 - 3. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements, for additional provisions.
 - b. Lock Cylinders: Ten for each master keyed group.
 - c. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.6 QUALITY ASSURANCE

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware upon receipt and store within secure lock-up for door hardware delivered to Project Site
- B. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

- C. Deliver keys to Owner representative. Tag and organize keys consistent with decisions made at keying conference ready to be installed within key control system.

1.8 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Manufacture agrees to replace or repair components exhibiting defects prior to end of warranty period. Complete forms in Owner's name and register with manufacturer.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. General hardware warranty period for all components unless otherwise indicated below: Three years.
 - a. Manual Closers: Ten years, minimum.
 - b. Exit Devices: Three years, minimum.
 - c. Locksets and Cylinders: Three years, minimum.
 - d. Concealed Floor Closers: Ten years, minimum.
 - e. Electromagnetic and Delayed Egress Locks: Five years minimum.

PART 2 PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Applicable provisions of NFPA 101.
 - 4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 - 6. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
 - a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.
 - 7. Listed and certified compliant with specified standards by BHMA (CPD).
 - 8. Auxiliary Hardware: BHMA A156.16.
 - 9. Straps and Tee Hinges: BHMA A156.20.
 - 10. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.

11. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
 12. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
- F. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 4. Provide wall grip inserts for hollow wall construction.
 5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
 6. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
 7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.2 HINGES

- A. General
1. Provide hinge width required to clear surrounding trim.
 2. Provide at a minimum, regardless of lesser quantity indicated elsewhere, the following number of butt hinges for each door:
 - a. Door Leaf up to 60 inches high: Two hinges.
 - b. Door Leaf from 60 inches high up to 90 inches high: Three hinges.
 - c. Door Leaf from 90 inches high up to 120 inches high: Four hinges.
 - d. Door Leaf over 120 inches High: One additional hinge per each additional 30 inches in height.
 - e. Dutch Doors: Two hinges each leaf.
- B. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7, Grade 1; Provide template produced hinges for installation on hollow metal frames, hollow metal doors, aluminum doors and flush wood doors on hollow metal frames.
1. Base Requirements:
 - a. Type: Five-knuckle, Full mortise.

- b. Weight Rating: Heavy weight.
 - c. Size: 4-1/2 x 4-1/2 inches.
 - d. Base Metal: Stainless Steel.
 - e. Bearing Type: Concealed, oil- and grease-free, maintenance free.
 - f. Pin Type: Stainless Steel.
 - g. Tip: Flat/Standard.
 - h. Finish: US32D/BHMA 630; Satin Stainless Steel.
 - 2. Options: Where indicated, provide the following options:
 - a. Non-Removable Pin (NRP) Option:
 - 1) Where indicated below or within the Hardware Schedule, provide manufacturer's standard non-removable pin held in place by set screw through barrel or other locking mechanism, concealed when hinge is in closed position.
 - 2) Provide on all exterior outswing doors.
 - 3) Provide on all doors with lockable or otherwise secure door hardware where hinge barrel is exposed on secure/key side of door.
 - b. Electrified Hinge Option:
 - 1) Where indicated, provide manufacturer's standard concealed wiring option for conducting current to electrified door hardware. Provide hinge with appropriate number of conductors and wire gauge as required by electrified hardware.
 - c. Security Stud Option:
 - 1) Where indicated, provide manufacturer's standard round stud welded to one hinge leaf and aligning with hole in opposite leaf.
 - 3. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Five Knuckle, Full Mortise
 - 1) Basis of Design McKinney; an Assa Abloy Group company; Model T4A3386 or T4A3786.
 - 2) BEST, dormakaba Group; Model CB199 or CB168.
 - 3) Hager Companies; Model CB1199.
- C. Continuous Hinges: Comply with BHMA A156.26; minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- 1. Base Requirements:
 - a. Type: Full mortise, Meshed gear profile, with full covering.
 - b. Weight Rating: Heavy weight.
 - c. Size: Full height of door.
 - d. Base Metal: Extruded Aluminum; 6063-T6.
 - e. Bearing Type: Integral polymer PTFE bearing.
 - f. Finish: US28/BHMA 628; Satin Aluminum Clear Anodized.
 - 2. Options: Where indicated, provide the following options:
 - a. Electrified Hinge Option:
 - 1) Where indicated, provide manufacturer's standard concealed wiring option for conducting current to electrified door hardware. Provide hinge with appropriate number of conductors and wire gauge as required by electrified hardware.
 - b. Fire Rated Hinges: Where indicated or required for compliance with fire rating indicated, provide hinge with steel fire pins to hold fire rated doors in place if required by testing.

3. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Continuous Geared, Full Mortise
 - 1) Basis of Design Pemko; an Assa Abloy Group company; Model FM_HD1.
 - 2) BEST, dormakaba Group; Model 661HD.
 - 3) Hager Companies; Model 780-112 HD.

2.3 DOOR BOLTS

- A. Automatic and Self Latching Flush Bolts: Comply with BHMA A156.3, designed for mortising into door edge; Include wear plates; Grade 1.
 1. Type: 25.
 2. Flush Bolt Throw: 3/4 inch, minimum.
 3. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
 4. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
 5. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
 6. Automatic Flush Bolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened; located on inactive leaf of pair of doors.
 7. Finish: US32D/BHMA 630; Satin Stainless Steel.
 8. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Continuous Geared, Full Mortise
 - 1) Basis of Design Rockwood; an Assa Abloy Group company; Model No. 2842 (Metal) or 2962 (Wood).

2.4 EXIT DEVICES

- A. Exit Devices: Comply with BHMA A156.3, Grade 1.
 1. Type: Rim, mortise, types as indicated within Hardware Schedule or as may be required to perform intended operation or fire protection (rating) as indicated.
 - a. Unless otherwise indicated provide mortise type exit devices.
 - b. Provide exit devices properly sized for door width and height.
 - c. Provide strike as recommended by manufacturer for application indicated.
 - d. Provide listed and labeled exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
 - 1) Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 - 2) Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspection agency acceptable to authority having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
 - e. For electrical options, provide quick connect plug-in pre-wired connectors.
 2. Configuration: Narrow design with square housing and full length push pad, and lever type trim on entrance side of door unless otherwise indicated.

- a. Lever design to match lockset trim.
3. Base Metal: Stainless steel for exposed parts.
4. Finish: US32D/BHMA 630; Satin Stainless Steel
5. Mechanical Options: Where indicated within Hardware Schedule, provide manufacturer's standard operational components.
 - a. Provide cylinder with cylinder dogging or locking trim.
 - b. Visual indicators.
6. Basis of Design Product: Subject to compliance with requirements, provide the following:
 - a. Basis of Design Von Duprin, an Allegion brand; 99/33 Series.

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 1. Provide small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 2. Provide cylinders from same manufacturer as locking device.
 3. Provide cams and/or tailpieces as required for locking devices.
 4. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.
 5. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Shall be as indicated within Hardware Schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.
- C. Backset: 2-3/4 inch unless otherwise indicated.
- D. Lock Trim:
 1. Description: ADA accessible, "L" shaped lever consisting of a round spindle and rectangular profile lever, with hooked lever returning to within 1/2 inch of door face; and a flat profile, square edged, round escutcheon, with concealed fasteners, prepared for key cylinder.
 2. Lever: Cast.
 - a. Base Metal: Stainless Steel.
 - b. Construction: Solid.
 - c. Basis of Design Lever Designation: 15D.
 3. Dummy Trim: Match lever lock trim and escutcheon.
 4. Escutcheons (Roses):
 - a. Base Metal: Stainless Steel.
- E. Strikes: Unless otherwise indicated, provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock and latch and with strike box and curved lip extended to protect frame; finished to match lock/latch.
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum Frame Strike Box: Manufacturer's spe
4. Rabbet Front and Strike: Provide on locksets for rabbetted meeting stiles.

F. Finish: US26D/BHMA 626; Satin Chrome Plated Brass/Bronze

G. CYLINDRICAL LOCKS

1. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1.
 - a. Bored Hole: 2-1/8 inch diameter.
 - b. Latchbolt Throw: 1/2 inch, minimum.
2. Basis of Design Product: Subject to compliance with requirements, provide the following:
 - a. Basis of Design BEST, dormakaba Group; 9K Series.

2.7 DOOR PULLS AND PUSH PLATES

- A. Door Pulls and Push Plates: Comply with BHMA A156.6.
1. Pull Type: Offset, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Stainless steel, unless otherwise indicated.
 4. Finish: US32D/BHMA 630; Satin Stainless Steel
- B. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
1. Rockwood; an Assa Abloy Group company; RM201 (Pull), HG70C (Push Plate).

2.8 COORDINATORS

- A. Manufacturers:
1. Rockwood; an Assa Abloy Group company.
 2. dormakaba.
 3. Hiawatha, Inc, division of Activar Construction Products Group, Inc.
 4. Ives, an Allegion brand.
 5. Pamex, Inc.
 6. Trimco.
- B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.9 CLOSERS

- A. Surface Closers: Comply with BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Type: Surface mounted to door.
 - 2. Provide door closer on each exterior door.
 - 3. Provide door closer on each fire-rated and smoke-rated door.
 - a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
 - 4. Where an overlapping astragal, self-latching flush bolts, or automatic flush bolts are included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
 - 5. Provide surface closer of configuration and arm type required for mounting on interior or room side of doors, unless specifically indicated otherwise.
 - 6. Provide full metal cover option.
 - 7. Size closer for each door based upon manufacturer's recommendation for weight and height of door, wind conditions, and closer location.
- B. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1. Corbin Russwin; an Assa Abloy Group company; DC8000.
 - 2. Norton Rixson; an Assa Abloy Group company; 7500 Series.
 - 3. Sargent; an Assa Abloy Group company; 351 Series.
 - 4. Accentra; an Assa Abloy Group company; 4400Series.
 - 5. BEST, dormakaba Group; HD8000.
 - 6. dormakaba; Architectural Hardware 8900 Series.

2.10 PROTECTION PLATES

- A. Protection Plates: Comply with BHMA A156.6.
- B. Metal Properties: Stainless steel material.
 - 1. Metal, Standard Duty: Thickness 0.050 inch, minimum.
 - 2. Metal, Heavy Duty: Thickness 0.062 inch, minimum.
 - 3. Metal, Extra Heavy Duty - Diamond Plate: Thickness 1/8 inch, minimum, with raised diamond plate surface.
 - 4. Metal, Extra Heavy Duty - Flat Plate: Thickness 1/8 inch, minimum, with smooth plate surface.
- C. Edges: Beveled, on four sides unless otherwise indicated.
- D. Fasteners: Countersunk screw fasteners.
- E. Provide clear anti-microbial coating that is silver ion-based.
- F. ARMOR PLATES
 - 1. Armor Plates: Provide on bottom half of push side and pull side of doors as indicated within Hardware Schedule, that require protection from objects moving through openings that may damage door surface.

- a. Size: 36 inches high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.
- b. Thickness: Standard Duty, Metal.

G. KICK PLATES

- 1. Kick Plates: Provide along bottom edge of push side where indicated within Hardware Schedule and all doors with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 - a. Size: 12 inch high by 2 inch less door width (LDW) on push side of door.
 - b. Thickness: Standard Duty, Metal.

H. MOP PLATES

- 1. Mop Plates: Provide along bottom edge of push side and pull side of doors to provide protection from cleaning liquids and equipment damage to door surface where indicated within the Hardware Schedule.
 - a. Size: 4 inches high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.
 - b. Thickness: Standard Duty, Metal.

2.11 DOOR HOLDERS

- A. Door Holders: Comply with BHMA A156.16, Grade 1.
 - 1. Provide surface mounted door holders when wall or floor stop is not applicable and hold-open device is mounted on door.
 - 2. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 - 3. Material: Aluminum.
 - 4. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Rockwood; an Assa Abloy Group company; No. 461.

2.12 FLOOR STOPS

- A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
 - 2. Material: Aluminum housing with rubber insert.
 - 3. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Rockwood; an Assa Abloy Group company; No. 442.

2.13 WALL STOPS

- A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Provide wall stops to prevent damage to wall surface upon opening door.
 - 2. Type: Bumper, concave, wall stop.
 - 3. Material: Aluminum housing with rubber insert.

4. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - a. Rockwood; an Assa Abloy Group company; No. 403.

2.14 THRESHOLDS

- A. Thresholds: Comply with BHMA A156.21.
 1. General
 - a. Provide threshold at interior doors where indicated within Hardware Schedule, unless otherwise indicated.
 - b. Provide thresholds at each exterior doors, unless otherwise indicated.
 - c. Provide threshold with Sound Transmission Class (STC) of 25-30 at locations indicated.
 - d. Threshold Surface: Fluted horizontal grooves across full width.
 - e. Field cut threshold to profile of frame and width of door sill for tight fit.
 - f. Provide non-corroding fasteners at exterior locations.
 2. Exterior Door Threshold; Rabbetted, thermally broken/improved threshold:
 - a. Metal members separated with PVC break and having an EBF seal that sealed against door face
 - b. Base Metal: Extruded Aluminum; 6063-T6.
 - c. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1) Zero International, Inc; No. 568.
 3. Saddle Threshold
 - a. Base Metal: Extruded Aluminum; 6063-T6.
 - b. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1) Zero International, Inc; No. 545.
 4. Acoustical Saddle Threshold; Thermally broken/improved threshold:
 - a. Metal members separated with PVC break.
 - b. Base Metal: Extruded Aluminum; 6063-T6.
 - c. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1) Zero International, Inc; No. 8724.

2.15 WEATHERSTRIPPING AND GASKETING

- A. General:
 1. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
 2. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 3. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.
 4. Provide applicable gasketing on doors indicated as "Lightproof."

- B. Weatherstripping and Gasketing: Comply with BHMA A156.22; resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. General
 - a. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:
 - 1) Gasketing on Single Doors: 0.3 cfm/sq. ft. of
 - 2) Gasketing on Double Doors: 0.5 cfm/sq/ ft. of door opening.
 - 2. Adhesive Backed Perimeter Gasketing: Neoprene bulb gasket material applied to to frame rabbet with self adhesive.
 - a. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1) Zero International, Inc; No. 8145S.

2.16 COAT HOOKS

- A. Coat Hooks: Provide on room side of door, screw fastened.
- B. Material: Stainless steel.
- C. Basis of Design Product: Subject to compliance with requirements, provide the following or comparable product by another manufacturer.
 - 1. Rockwood; an Assa Abloy Group company; No. RM 802.

2.17 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door Hardware Schedule or indicated within individual component articles above.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they re within the range of approved Samples and are assembled or installed to minimize contrasts.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.
- E. Do not install surface mounted items until application of finishes to substrate are fully completed.
- F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 - 1. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch.
 - b. Push Plates/Pull Bars: 42 inch.
 - c. Deadlocks (Deadbolts): 48 inch.
 - d. Exit Devices: 40-5/16 inch.
 - e. Door Viewer: 43 inch; standard height 60 inch.
- G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01 4000 - Quality Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

- A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.5 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.
- D. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

3.6 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 08 7100

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SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass products.
 - 2. Glazing sealants.
 - 3. Glazing tapes.
 - 4. Miscellaneous glazing materials.

1.2 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. AAMA GDSG-1 - Glass Design Guide for Sloped Glazing and Skylights.
- C. AAMA TIR-A7 - Sloped Glazing Guidelines.
- D. ASTM C1036 - Standard Specification for Flat Glass.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- G. IGMA TB-3001 - Guidelines for Sloped Glazing.
- H. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- I. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- J. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

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

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass.

1.8 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.

- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 0.24 inch thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.4 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
1. Neoprene with Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks:
1. Neoprene with Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended in writing by sealant or glass manufacturer.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- (3-mm-) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

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

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

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

3.7 CLEANING AND PROTECTION

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

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass: Annealed Fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

END OF SECTION 08 8000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 REFERENCE STANDARDS

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- G. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- J. ASTM E413 - Classification for Rating Sound Insulation.
- K. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- L. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- M. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.

- N. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses and types of steel framing, fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, stapping, bracing, bridgin, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated Design Submittal: For steel framing systems for interior partitions, bulkheads, soffits, other metal framed elements.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed, high-strength steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design steel framing system.
- B. Performance of Metal Framing System: Provide steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Non-Load Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 10 lbs/sq. ft.
 - b. Ceiling/Bulkhead/Soffit Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

- C. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
 - 1. Steel Studs and Tracks:
 - 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) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) MRI Steel Framing, LLC.
 - 6) Phillips Manufacturing Co.
 - 7) Steel Network, Inc. (The).
 - 8) Telling Industries.
 - b. Minimum Base-Steel Thickness: As indicated on Drawings .
 - c. Depth: As indicated on Drawings.
 - 2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
 - 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) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Phillips Manufacturing Co.
 - 6) Steel Network, Inc. (The).
 - 7) Telling Industries.
 - b. Minimum Base-Steel Thickness: As indicated on Drawings.
 - 1) Where not indicated on drawings, the minimum stud thickness shall be no less than 20 Gauge. ("20 Ga equivalent" is not compliant.)
 - c. Depth: As indicated on Drawings.

- C. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
 - 2) CEMCO; California Expanded Metal Products Co.; SLP-TRK Slotted Deflection Track.
 - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 4) MBA Building Supplies; Slotted Deflecto Track.
 - 5) Metal-Lite; The System.
 - 6) Steel Network, Inc. (The); VertiTrack VTD.
 - 7) Telling Industries; Vertical Slip Track.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CEMCO; California Expanded Metal Products Co.; FAS Track.
 - b. ClarkDietrich Building Systems; BlazeFrame.
 - c. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - d. Metal-Lite; The System.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
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. ClarkDietrich Building Systems.
 - b. MRI Steel Framing, LLC.
 2. Depth: As indicated on Drawings.
 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- (1.72-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
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. ClarkDietrich Building Systems.
 - b. MRI Steel Framing, LLC.
 2. Minimum Base-Steel Thickness: 0.0296 inch.
 3. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
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. ClarkDietrich Building Systems.
 - b. MRI Steel Framing, LLC.
 2. Configuration: Asymmetrical.

- H. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich Building Systems.
 - b. MRI Steel Framing, LLC.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F 738M), and nuts, ASTM F594 (ASTM F 836M).
 - 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 - 3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.

- b. Depth: As indicated on Drawings.
 - 4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - 5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension .
 - c. United States Gypsum Company; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Install strapping, bridging, and bracing within walls as required by AHJ.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: As required by horizontal deflection performance requirements 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

- a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
 - a. Frame with curved wall track product; locate straight lengths so they are tangent to arcs.
 - 1) Basis of Design Product: Subject to compliance with requirements, provide CircleTrak as manufactured by The Steel Network, Inc. or comparable product by another manufacturer.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

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SECTION 09 2900 - GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.2 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- E. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- J. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- K. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.
- L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- N. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- O. ASTM E413 - Classification for Rating Sound Insulation.

1.3 RELATED REQUIREMENTS:

- A. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
- B. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
- C. Section 09 3013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Gypsum wallboard.
 - 2. Gypsum board, Type X.
 - 3. Flexible gypsum board.
 - 4. Gypsum ceiling board.
 - 5. Impact-resistant gypsum board.
 - 6. Mold-resistant gypsum board.
 - 7. Glass-mat, water-resistant backing board.
 - 8. Interior trim.
 - 9. Joint treatment materials.
 - 10. Laminating adhesive.
 - 11. Sound-attenuation blankets.
 - 12. Acoustical sealant.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

- A. 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. Certaineed Gypsum
 - 2. Georgia Pacific Gypsum LLC.
 - 3. National Gypsum Company
 - 4. USG Corporation
- B. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- D. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch.
 - 2. Long Edges: Tapered.
- E. Gypsum Ceiling Board: ASTM C1396/C1396M.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
- F. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
 - 1. Core: As indicated on Drawings.
 - 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 - 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.

4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
6. Long Edges: Tapered.

- G. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.
1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 2. Long Edges: Tapered.
- B. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Core: As indicated 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.
1. Core: As indicated on Drawings .

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet .
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.

2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 07 9219 "Acoustical Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.

2. Type X: As indicated on Drawings.
 3. Flexible Type: Apply in double layer at curved assemblies.
 4. Ceiling Type: Ceiling surfaces.
 5. Impact-Resistant Type: As indicated on Drawings.
 6. Mold-Resistant Type: As indicated on Drawings.
 7. Type C: Where required for specific fire-resistance-rated assembly indicated.
 8. Glass-Mat Interior Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
- 3.4 INSTALLATION OF TILE BACKING PANELS
- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
- C. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges.
 - 5. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for acoustical tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
 - 5. Level 5: Where indicated on drawings and where required for finish installation. Coordinate all gypsum board surfaces with finish system providers and installers.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

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SECTION 09 3013 - CERAMIC TILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceramic mosaic tile.
 - 2. Porcelain tile.
 - 3. Ceramic wall tile.
 - 4. Thresholds.
 - 5. Tile backing panels.
 - 6. Waterproof membranes.
 - 7. Crack isolation membranes.

1.2 REFERENCE STANDARDS

- A. ANSI A108.01 - General Requirements: Structures, Substrates, and Preparation of Tile.
- B. ANSI A108.02 - General Requirements: Workmanship for Tile Installation.
- C. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- D. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.
- F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- G. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.
- H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- I. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- J. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- K. ASTM C503/C503M - Standard Specification for Marble Dimension Stone.
- L. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.

1.3 RELATED REQUIREMENTS:

- A. Section 07 9200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.4 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Module Size: Actual tile size plus joint width indicated.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Stone thresholds in 6-inch (150-mm) lengths.
 - 3. Metal edge strips in 6-inch (150-mm) lengths.

1.7 INFORMATIONAL SUBMITTALS

- A. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

- A. Factory-Mounted Mosaic Ceramic Tile
 - 1. Type CT-5: Glazed.

- a. Product: Subject to compliance with requirements, provide Mosaic Tile Company, Color Blox 2.0 Series mosaic porcelain tile.
 - b. Composition: Porcelain.
 - c. Mosaic Backed Sheet Size: Approximately 12 x 12 inches.
 - d. Individual Tile Size: 3 x 3 inches
 - e. Thickness: 6.4 mm.
 - f. Grout Color: As selected by Architect from manufacturer's full range.
 2. Type CT-7: Glazed.
 - a. Product: Subject to compliance with requirements, provide Mosaic Tile Company, Trajectory Series mosaic porcelain tile.
 - b. Composition: Porcelain.
 - c. Mosaic Backed Sheet Size: Approximately 14 x 14 inches.
 - d. Individual Tile Size: Approximately 2 inch diameter round tiles.
 - e. Thickness: 9.5 mm.
 - f. Grout Color: As selected by Architect from manufacturer's full range.
- B. Porcelain Tile Type CT-1, CT-2, & B-3: Glazed.
1. Product: Subject to compliance with requirements, provide Mosaic Tile Company, Color Blox 2.0 porcelain tile or comparable product by another manufacturer.
 - a. Tile Face Size: 12 x 24 inches.
 - b. Base Face Size: 6 x 12 inches.
 - c. Tile Thickness: 9.5 mm.
 - d. Dynamic Coefficient of Friction: Not less than 0.42.
 - e. Tile Color and Pattern: As indicated on drawings.
 - f. Grout Color: As selected by Architect from manufacturers full range.
- C. Porcelain Tile Type CT-3 & CT-4: Glazed.
1. Product: Subject to compliance with requirements, provide Mosaic Tile Company, Color Blox 2.0 porcelain tile or comparable product by another manufacturer.
 - a. Tile Face Size: 4 x 12 inches.
 - b. Tile Thickness: 9.5 mm.
 - c. Dynamic Coefficient of Friction: Not less than 0.42.
 - d. Tile Color and Pattern: As indicated on drawings.
 - e. Grout Color: As selected by Architect from manufacturers full range.
- D. Porcelain Tile Type CT-6, CT-8, & B-4: Glazed.
1. Product: Subject to compliance with requirements, provide Mosaic Tile Company, Trajectory Series porcelain tile or comparable product by another manufacturer.
 - a. Face Size: 12 x 24 inches.
 - b. Base Face Size: 6 x 12 inches.
 - c. Thickness: 9.5 mm.
 - d. Dynamic Coefficient of Friction: Not less than 0.42.
 - e. Tile Color and Pattern: As indicated on drawings.
 - f. Grout Color: As selected by Architect from manufacturers full range.
- E. Ceramic Tile Type CT-9
1. Basis of Design Product: Subject to compliance with requirements, provide Mosaic Tile Company, Terralma Series ceramic wall tile or comparable by another manufacturer.

2. Face Size: 3 x 14 inches.
3. Thickness: 8 mm.
4. Tile Color and Pattern: As indicated on drawings.
5. Grout Color: As selected by Architect from manufacturers full range.

2.4 ACCESSORIES

- A. Shower Corner Shelf:
1. Basis of Design Product: Subject to compliance with requirements provide, Mosaic Corner Shelf or comparable product by another manufacturer.

2.5 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 12 according to ASTM C1353 or ASTM C241/C241M and with honed finish.
1. Description:
 - a. Uniform, fine- to medium-grained white stone with gray veining.

2.6 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
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. C-Cure.
 - b. Custom Building Products.
 - c. FinPan, Inc.
 - d. Georgia-Pacific Gypsum LLC.
 - e. USG Corporation.
 2. Thickness: 5/8 inch.

2.7 WATERPROOF MEMBRANES

- A. Waterproof Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
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. Boiardi Products Corporation; a QEP company.
 - b. Custom Building Products.
 - c. H.B. Fuller Construction Products Inc. / TEC.
 - d. Laticrete International, Inc.

- e. MAPEI Corporation.

2.8 CRACK ISOLATION MEMBRANES

- A. Crack Isolation Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Boiardi Products Corporation; a QEP company.
 - b. Custom Building Products.
 - c. H.B. Fuller Construction Products Inc. / TEC.
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation.

2.9 SETTING MATERIALS

- A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 - 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. ARDEX Americas.
 - b. C-Cure.
 - c. Custom Building Products.
 - d. H.B. Fuller Construction Products Inc. / TEC.
 - e. Laticrete International, Inc.
 - f. MAPEI Corporation.
 - g. Merkrete; a Parex USA, Inc. brand.
 - h. Sakrete; CRH Americas, Oldcastle APG.
 - i. Siena Products; Omega.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
 - 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.10 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
 - 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. Boiardi Products Corporation; a QEP company.
 - b. Custom Building Products.
 - c. H.B. Fuller Construction Products Inc. / TEC.
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation.
 - 2. Polymer Type:
 - a. Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.
- B. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

2.11 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666/A666M, 300 Series exposed-edge material.
 - 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. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.
 - c. Schluter Systems L.P.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 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. Custom Building Products.
 - b. Jamo Inc.
 - c. Laticrete International, Inc.
 - d. Sakrete; CRH Americas, Oldcastle APG.
 - e. Southern Grouts & Mortars, Inc.
 - f. Summitville Tiles, Inc.
 - g. .

2.12 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - b. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain Tile: 1/4 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Floor Sealer: Apply floor sealer to cementitious grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 INSTALLATION OF WATERPROOF MEMBRANES

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

3.6 INSTALLATION OF CRACK ISOLATION MEMBRANES

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 1. TCNA F113 : Thinset mortar.
 - a. Thinset Mortar: Improved modified dry-setmortar.
 - b. Grout: High-performance sanded grout.
 2. TCNA F122: Thinset mortar on waterproof membrane.
 - a. Thinset Mortar: Improved modified dry-setmortar.
 - b. Grout: High-performance sanded grout.
- B. Interior Wall Installations, Masonry or Concrete:
 1. TCNA W202 : Thinset mortar.
 - a. Thinset Mortar: Improved modified dry-set mortar.
 - b. Grout: High-performance sanded grout.
- C. Interior Wall Installations, Wood or Metal Studs or Furring:
 1. TCNA W231/W241 and ANSI A108.1A ANSI A108.1B ANSI A108.1C: Cement mortar bed (thickset).
 - a. Bond Coat for Wet-Set Method: Standard dry-set mortar.
 2. TCNA W244C or TCNA W244F : Thinset mortar on cementitious backer units or fiber-cement backer board.
 - a. Thinset Mortar: Improved modified dry-setmortar.
 - b. Grout: High-performance sanded grout.

END OF SECTION 09 3013

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCE STANDARDS

- A. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- I. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling 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. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - 7. Minimum Drawing Scale: 1/4 inch = 1 foot.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS ACT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong; Ultima High-NRC or comparable product by one of the following:
 - 1. American Gypsum.
 - 2. Armstrong World Industries, Inc.
 - 3. CertainTeed Corporation.
 - 4. Chicago Metallic Corporation.
 - 5. Tectum Inc.
 - 6. United States Gypsum Company. Basis of Design
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide fire-resistance-rated panels as follows:
 - 1. Type and Form: Type A, mineral base with membrane-faced overlay; Form A2.2, water felted; with manufacturer's standard acoustically transparent water repellent membrane on face.
 - 2. Pattern: E
- D. Color: White .
- E. Light Reflectance (LR): Not less than 0.85.
- F. Ceiling Attenuation Class (CAC): Not less than 35.
- G. Noise Reduction Coefficient (NRC): Not less than 0.80.
- H. Edge/Joint Detail: Square .
- I. Thickness: 7/8 inch.
- J. Modular Size: 24 by 24 inches.

- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D 3274, or ASTM G21 and evaluated according to ASTM D 3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude XL suspension system or comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. CertainTeed Corporation.
 3. Chicago Metallic Corporation.
 4. United States Gypsum Company. Basis of Design

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 ???Insert safety factor??? times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 4. Size: Wire diameter sufficient for its stress at three times hanger design load (((ASTM C635/C635M))), Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch- (3.5-mm-) Insert dimension diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- E. Hold-Down Clips: Manufacturer's standard hold-down.
- F. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- G. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard antimicrobial gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.

9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 3. Install hold-down impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - a. Hold-Down Clips: Space 24 inches Insert dimension o.c. on all cross runners.
 4. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

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SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic-rubber base.
 - 2. Rubber molding accessories.

1.2 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE B-1 & B-2

- 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. Allstate Rubber Corp.
 - 2. Armstrong World Industries, Inc.
 - 3. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 4. Flexco.
 - 5. Johnsonite; A Tarkett Company. Basis of Design Product
 - 6. Nora Systems, Inc.
 - 7. Roppe Corporation, USA.
 - 8. VPI Corporation.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style B, Cove: .
- C. Thickness: 0.125 inch.
- D. Height: 6 inc.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As selected by Architect from manufacturer's full range.

2.2 RUBBER MOLDING ACCESSORY

- A. Description: Rubber cap for cove carpet cap for cove resilient floor covering carpet bar for tackless installations carpet edge for glue-down applications nosing for carpet nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips.
- B. Profile and Dimensions: As indicated.
- C. Colors and Patterns: As selected by Architect from manufacturers full range.

2.3 INSTALLATION MATERIALS

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

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas. Provide one or both tests below as recommended and/or required by product manufacturer(s).
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

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

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

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SECTION 09 6566 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rubber floor tile.
- B. Related Sections:
 - 1. Section 09 6513 "Resilient Base and Accessories" for wall base and accessories installed with flooring.

1.2 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details and locations of the following:
 - 1. Border tiles.
 - 2. Floor patterns.
 - 3. Layout, colors, widths, and dimensions of game lines and markers.
 - 4. Locations of floor inserts for athletic equipment installed through flooring.
- C. Samples for Initial Selection: For each type of flooring indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified sheet vinyl flooring Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store .

1.8 FIELD CONDITIONS

- A. Adhesively Applied Products:
 - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 degrees Fahrenheit or more than 95 degrees Fahrenheit, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 degrees Fahrenheit or more than 95 degrees Fahrenheit.
 - 3. Close spaces to traffic during flooring installation.
 - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

1.9 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

PART 2 PRODUCTS

2.1 RUBBER FLOOR TILE RF-1

- A. Basis of Design Product: Subject to compliance with requirements, provide Regupol, Aktivlok high-performance interlocking recycled rubber flooring or comparable product by another manufacturer.
- B. Description: Athletic flooring consisting of modular rubber tiles with smooth edges for adhered application.
- C. Material: Recycled-rubber compound.
- D. Traffic-Surface Texture: Smooth.
- E. Size: 24 inches square.
- F. Thickness: 3/8 inches.
- G. Color and Pattern: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 FLOOR TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- B. Discard broken, cracked, chipped, or deformed tiles.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.
- D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 CLEANING AND PROTECTING

- A. Perform the following operations immediately after completing flooring installation:
 - 1. Sweep and vacuum flooring thoroughly.
 - 2. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6566

SECTION 09 6723 - RESINOUS FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resinous flooring.
 - 2. Integral cove base accessories.

1.2 REFERENCE STANDARDS

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- C. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
 - 2. Review details of integral cove bases.
 - 3. Review manufacturer's written instructions for installing resinous flooring systems.
 - 4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.
- B. Samples: For each resinous floor system required and for each color and texture specified, 6 inches (150 mm) square in size, applied to a rigid backing by Installer for this Project.
- C. Samples for Initial Selection: For each type of exposed finish required.

- D. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches square, applied to a rigid backing by Installer for this Project.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each resinous flooring component.
- B. Material Test Reports: For each resinous flooring system, by a qualified testing agency.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 96-inch- (2400-mm-) square floor area selected by Architect.
 - a. Include 96-inch (2400-mm) length of integral cove base with inside and outside corner.
 - 2. Simulate finished lighting conditions for Architect's review of mockups.
 - 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.
- C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.1 RESINOUS FLOORING RES-1 & B-5

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Dur-a-Flex, Hybri-Flex ultra high solids multi-component resinous flooring system.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
- C. System Characteristics:
 - 1. Color and Pattern: As selected by Architect from manufacturer's full range.
 - 2. Wearing Surface: Textured for slip resistance .
- D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.
- E. System Components

2.2 INTEGRAL COVE BASE ACCESSORIES

- A. Precast, Integral Cove Base: Impact-resistant, polymer-resin, cove base moldings with a grit profile to promote adhesion of resinous flooring and recommended in writing by resinous flooring manufacturer.
 - 1. Radius Cove: Cove molding with approximately 1-inch (25-mm) radius for adhesive installation at floor-to-wall joint as substrate to receive resinous flooring system to form an integral cove base.
 - 2. Radius Cove Base: 6-inch- (152-mm-) high base molding that provides approximately 1-inch (25-mm) radius cove at floor-to-wall joint; for adhesive installation as substrate for resinous flooring system to form an integral cove base.
 - a. Preformed Inside and Outside Corners: Provide manufacturer's standard square inside and 3/4- to 1-inch (19- to 25-mm) bullnose outside corners.
- B. Installation Adhesive: As recommended in writing by accessory manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with requirements in SSPC-SP 13/NACE No.6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
 - 2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
 - 3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas. Provide one or both of the following tests per manufacturer's requirements and recommendations for installation and to maintain product warranty(ies).
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.
 - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
 - 1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
 - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

- C. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.
- D. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
- E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.
 - 1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.
- G. Grout Coat: Apply grout coat to fill voids in surface of final body coat.
- H. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.
 - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.
- B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 6723

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SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular carpet tile.

1.2 REFERENCE STANDARDS

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- B. CRI 104 - Standard for Installation of Commercial Carpet.

1.3 RELATED REQUIREMENTS:

- A. Section 09 6513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.

8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
 - C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
 - D. Samples for Initial Selection: For each type of carpet tile.
 1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
 - E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
 - C. Sample Warranty: For special warranty.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- 1.8 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Comply with the Carpet and Rug Institute's CRI 104.
- 1.10 FIELD CONDITIONS
- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
 - B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CARPET TILE

- A. Basis of Design Product: Subject to compliance with requirements provide product indicated on drawings or comparable product by another manufacturer.
- B. Color: As indicated by manufacturer's designations.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill Insert finish finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 3000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Metal Subfloors: Verify the following:
 - 1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

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SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Gypsum board.
 - 6. Acoustic panels and tiles.

1.2 REFERENCE STANDARDS

- A. ASTM D523 - Standard Test Method for Specular Gloss.
- B. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.
- C. SSPC-SP 2 - Hand Tool Cleaning.
- D. SSPC-SP 3 - Power Tool Cleaning.
- E. SSPC-SP 7/NACE No.4 - Brush-Off Blast Cleaning.
- F. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal.

1.3 RELATED REQUIREMENTS:

- A. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
- B. Section 09 9600 "High-Performance Coatings" for tile-like coatings.

1.4 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product. (Color Fan)
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.7 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.9 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Duron, Inc.
 - 4. M.A.B. Paints.
 - 5. PPG Architectural Coatings.
 - 6. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors: As selected by Architect from manufacturer's full range .

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
 - 3. Gypsum Board: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No.4.
 - 4. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - i. ???Insert mechanical items to be painted???
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. High-Performance Architectural Latex System MPI INT 3.1C:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
- B. CMU Substrates:
 - 1. High-Performance Architectural Latex System MPI INT 4.2D:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
- C. Steel Substrates:
 - 1. High-Performance Architectural Latex System MPI INT 5.1R:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2).
- D. Galvanized-Metal Substrates:
 - 1. High-Performance Architectural Latex System MPI INT 5.3M:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) ???Insert manufacturer's name; product name or designation???.

E. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

END OF SECTION 09 9123

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SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete, vertical surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
 - d. Galvanized metal.
 - 2. Interior Substrates:
 - a. Concrete, vertical surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
 - d. Galvanized metal.
 - e. Gypsum board.

1.2 REFERENCE STANDARDS

- A. ASTM D523 - Standard Test Method for Specular Gloss.
- B. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.
- C. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning.

1.3 RELATED REQUIREMENTS:

- A. Section 09 9123 "Interior Painting" for general field painting.

1.4 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.5 ACTION SUBMITTALS

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

2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 1. Submit Samples on rigid backing, 8 inches square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Behr Process Corporation.
 2. Benjamin Moore & Co.
 3. PPG Architectural Finishes, Inc.
 4. Sherwin-Williams Company (The).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Color selection is often limited because some coating materials yellow or degrade under some environmental conditions.
- E. Colors: As selected by Architect from manufacturer's full range .

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 1. Clean surfaces with pressurized water. Use pressure range of 4000 to 10,000 psi at 6 to 12 inches (150 to 300 mm).
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches (150 to 300 mm).
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 1. SSPC-SP 6/NACE No.3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 1. Use applicators and techniques suited for coating and substrate indicated.
 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Vertical Surfaces:
 - 1. Epoxy-Modified Latex System MPI EXT 3.1E:
 - a. Prime Coat: Epoxy-modified latex, matching topcoat.
 - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
- B. CMU Substrates:
 - 1. Epoxy System MPI EXT 4.2E:
 - a. Block Filler: Block filler, epoxy, MPI #116.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- C. Steel Substrates:
 - 1. Epoxy System MPI EXT 5.1F:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- D. Galvanized-Metal Substrates:
 - 1. Epoxy System MPI EXT 5.3C:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Vertical Surfaces:
 - 1. Epoxy-Modified Latex System MPI INT 3.1G:
 - a. Prime Coat: Epoxy-modified latex, matching topcoat.
 - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

- B. CMU Substrates:
 - 1. Epoxy-Modified Latex System MPI INT 4.2J:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
- C. Steel Substrates:
 - 1. Epoxy-Modified Latex System MPI INT 5.1K:
 - a. Prime Coat: Primer, rust inhibitive, water based, MPI #107.
 - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
- D. Galvanized-Metal Substrates:
 - 1. Epoxy over Epoxy Primer System MPI INT 5.3D:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- E. Gypsum Board Substrates:
 - 1. Epoxy-Modified Latex System MPI INT 9.2F:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
 - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

END OF SECTION 09 9600

SECTION 10 1423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.

1.2 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- C. ADA Standards - 2010 ADA Standards for Accessible Design.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. ASTM D4802 - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
 - 2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 - 3. Exposed Accessories: Full-size Sample of each accessory type.
 - 4. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACE Sign Systems, Inc.

- b. Advance Corporation.
 - c. Allen Industries Architectural Signage.
 - d. APCO Graphics, Inc.
 - e. ASE, Inc.
 - f. ASI Sign Systems, Inc.
 - g. Best Sign Systems, Inc.
 - h. Clarke Systems.
 - i. Cosco.
 - j. Diskey Architectural Signage Inc.
 - k. InPro Corporation (IPC).
 - l. Mohawk Sign Systems.
 - m. Nelson-Harkins Industries.
 - n. Poblocki Sign Company, LLC.
 - o. Seton Identification Products.
 - p. Signature Signs, Inc.
 - q. Signs & Decal Corp.
 - r. Stamprite Supersine; a division of Stamp Rite Inc.
 - s. Vista System.
 - t. Vomar Products, Inc.
- 2. Laminated-Sheet Sign: Sandblasted polymer Insert material face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: As indicated on Drawings.
 - b. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Corner Condition in Elevation: As indicated on Drawings.
 - 4. Mounting: Manufacturer's standard method for substrates indicated with two-face tape.
 - 5. Text and Typeface: Accessible raised characters and Braille . Finish raised characters to contrast with background color, and finish Braille to match background color.
 - a. Font: Gill Sans; 3/4 inches high
 - b. Room names may be changed through the shop drawing review process.
- B. Location and Quantity: Signage shall be provided at a minimum of every doorway throughout the building. Provide two signs for every interior door. Final quantity shall be determined during shop drawing process but shall not be more than stated above.

2.3 SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- B. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.
- D. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
 - 1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I.

- B. Color Anodic Finish: AAMA 611, Class I.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils . Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 - 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 - 2. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 1423.16

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SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.

1.2 REFERENCE STANDARDS

- A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- B. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.
- F. NFPA 70 - National Electrical Code.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

3. Include electrical characteristics.

- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Materials: As indicated on drawings.

2.2 PERFORMANCE 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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
 2. Shower Seats: Installed units are able to resist 360 lbf (1601 N) applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Jumbo Roll) Dispenser; TP1
1. Basis of Design Product: Subject to compliance with requirements, provide Tork, T10 toilet paper dispenser or comparable product by another manufacturer.
 2. Description: Two roll unit with sliding panel to expose other roll.

3. Mounting: Surface.
 4. Capacity: (2) mid-sized (2,000 sheet) rolls.
 5. Material and Finish: ABS plastic, with translucent front cover.
- C. Paper Towel (Roll) Dispenser PT1:
1. Basis of Design Product: Subject to compliance with requirements, provide Tork model 772720 Paper Towel Dispenser or comparable product by another manufacturer.
 2. Description: Pull-towel-actuated mechanism that permits controlled delivery of paper rolls in preset lengths.
 3. Mounting: Surface.
 4. Minimum Capacity: 8 inch wide, 800 foot long roll.
 5. Material and Finish: ABS plastic, white.
- D. Grab Bar GB-#:
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick model B-51806.99 Straight Grab Bar or comparable product by another manufacturer.
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 4. Outside Diameter: 1-1/2 inches.
 5. Configuration and Length: As indicated on Drawings.
- E. Sanitary-Napkin Disposal Unit SN1:
1. Basis of Design Product: Subject to compliance with requirements, provide Bradley Corporation model 4A10 Surface Mounted Sanitary Napkin Disposal or comparable product by another manufacturer
 2. Mounting: Surface mounted.
 3. Door or Cover: Self-closing, disposal-opening cover.
 4. Receptacle: Removable.
 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- F. Framed Mirror Unit MR#:
1. Basis of Design Product: Subject to compliance with requirements, provide American Specialties, Inc model #0620 Channel Frame Mirror or comparable product by another manufacturer
 2. Frame: Stainless steel channel.
 - a. Corners: Manufacturer's standard.
 3. Size: As indicated on Drawings.
 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
- G. Frameless Plate Glass Mirror EQ-16
1. Basis of Design Product: Subject to compliance with requirements, provide American Specialties, Inc. model 8287 Frameless Polished Plate Glass Mirror - 1/4 inch thick or comparable product by another manufacturer.
 2. Size: As indicated on drawings.
 3. Mounting: Mount per manufacturers written instructions.

2.4 UNDERLAVATORY GUARDS

- A. Underlavatory Guard :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckaroos, Inc.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro by IPS Corporation.
 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Shower Curtain Rod :
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick model B-6107 Heavy Duty Shower Curtain Rod with Concealed Mounting or comparable product by another manufacturer
 2. Description: 1-inch- (25.4-mm-) outside diameter, straight rod.
 3. Configuration: As indicated on Drawings
 4. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
 5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- C. Shower Curtain :
1. Size: Minimum 12 inches wider than opening by 72 inches high.
 2. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
 3. Color: White.
 4. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
 5. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
- D. Folding Shower Seat :
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick model B-5192 Solid Phenolic Folding Shower/Dressing Area Seat or comparable product by another manufacturer
 2. Configuration: Rectangular seat.
 3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
 4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- E. Robe Hook: RH1
1. Basis of Design Product: Subject to compliance with requirements, provide American Specialties, Inc. Model #7345-B or comparable product by another manufacturer.
 2. Description: Double prong unit.
 3. Material and Finish: Stainless steel ASTM A480/A480M No. 4 finish (satin).

2.6 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Custodial Mop and Broom Holder with Shelf:
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick model B-239 or comparable product by another manufacturer.
 - 2. Description: Unit with shelf, hooks, and holders..
 - 3. Length: 34 inches.
 - 4. Hooks: Four.
 - 5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

2.7 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666/A666M, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- C. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- D. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 0.24 inch thick.

2.8 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.
- B. Related Requirements:
 - 1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Architectural Series Fire Extinguisher Cabinets as manufactured by Larsen's Manufacturing Company or comparable product by another manufacturer.
- B. Provide fire rated cabinets where cabinets are located within fire rated construction/assemblies.
 - 1. Rating shall match the assembly rating.
- C. Cabinet Material: .
 - 1. Surface mount cabinets shall have same metal and finish as cabinet door.
 - 2. Recessed and Semi-recessed cabinets shall have cold-rolled steel sheet with white baked enamel finish.
 - a. Trim shall match door material and finish.
- D. Recessed Cabinet:
 - 1. Basis of Design Product: 2409-R2; Larsen's Manufacturing Company.
 - 2. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Basis of Design Product: 2409-RA; Larsen's Manufacturing Company.
 - 2. Rolled-Edge Trim: 4-inch (102-mm) backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
 - 1. Basis of Design Product: 2409-SM; Larsen's Manufacturing Company.
- G. Cabinet Trim Material: Stainless steel sheet.
- H. Door Material: Stainless steel sheet.
- I. Door Style: Fully glazed panel with frame.
- J. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color:
 - a. Clear transparent acrylic sheet.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Engraved.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/A480M No. 4 directional satin finish,.
3. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames of one-piece construction with edges flanged.
 2. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 3. Fire-Rated Cabinets:
 - a. Seal through penetrations with firestopping sealant as specified in Section 07 84 13 "Penetration Firestopping."

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

SECTION 10 4416 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried wheeled fire extinguishers and mounting brackets for fire extinguishers.

1.2 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers.

1.3 RELATED SECTIONS

- A. Section 10 4413 "Fire Protection Cabinets."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International.
 - c. Babcock-Davis.
 - d. Badger Fire Protection.
 - e. Buckeye Fire Equipment Company.
 - f. Fire End & Croker Corporation.
 - g. Guardian Fire Equipment, Inc.
 - h. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - i. Kidde Residential and Commercial Division.
 - j. Larsens Manufacturing Company.
 - k. MOON American.
 - l. Nystrom, Inc.
 - m. Oval Fire Products Corporation.
 - n. Potter Roemer LLC.
 - o. Pyro-Chem; Tyco Fire Suppression & Building Products.
 - p. Strike First Corporation of America (The).
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container Insert drawing designation: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Fire extinguishers shall be placed in all fire extinguisher cabinets indicated within drawings as well as in all mechanical rooms, electrical rooms, and elevator machine rooms.
 - 2. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

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SECTION 10 5126 - PLASTIC LOCKERS AND BENCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid plastic lockers.

1.2 REFERENCE STANDARDS

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each type of product indicated include fabrication details, description of materials and finishes.
 - 1. Product Test Reports: When requested by Architect, provide documentation indicating compliance of products with requirements, from a qualified independent testing agency.
- B. Shop Drawings: Include overall locker dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.
- C. Samples for Selection: Furnish samples of manufacturer's full range of colors for initial selection.
- D. Samples for Approval: Furnish a physical sample of the material in the selected color.
 - 1. Size: 6 by 6 inch (102 by 102 mm) in type of finish specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Installation instructions.
- B. Warranty: Sample of special warranty.

1.6 MAINTENANCE SUBMITTALS

- A. Operation and Maintenance Data.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic lockers and trim accessories from single manufacturer.
- B. Accessibility Requirements: Comply with requirements of ADA/ABA and with requirements of authorities having jurisdiction.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 100 or less.
 - 2. Smoke-Developed Index: 450 or less.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver plastic lockers to the site until the building is enclosed and HVAC systems are in operation. Deliver plastic lockers in manufacturer's original packaging. Store in an upright condition. Protect plastic lockers from exposure to direct sunlight.
- B. Ship plastic lockers fully assembled.
- C. Lift and handle plastic lockers from the base not the sides.

1.9 WARRANTY

- A. Special Manufacturer's Warranty: 20 year against rust, delamination or breakage of plastic parts under normal use.

PART 2 PRODUCTS

2.1 MATERIALS

- A. High Density Polyethylene (HDPE): 100 percent pre-consumer or post-consumer recycled content polyethylene thermoplastic formed under high pressure into solid plastic components.
- B. Stainless-Steel Sheet: ASTM A666/A666M, Type 304.
- C. Fasteners: Tamper-Resistant Fasteners: Stainless steel torx-head screws.
 - 1. Locker Connectors: No. 10-24 sex bolts.
 - 2. Anchors: Type and size required for secure anchorage.
 - 3. Drilled-in-place Masonry Anchors: Minimum 1/4 by 1-3/4 inch screws.

2.2 STANDARD PLASTIC LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley LENOXLOCKER or comparable product by another manufacturer.
- B. Locker Configuration: One Tier.
- C. Locker Dimensions

1. EQ8: 18 wide x 18 inches deep x 60 high.
- D. Material: HDPE plastic, 100 percent recycled material.
- E. Sides, Tops, Bottoms, Dividers, and Shelves: 3/8 inch thick HDPE plastic with smooth finish.
- F. Locker Shelves: 3/8 inch HDPE plastic, mortised into sides and back.
- G. Locker Tops: Flat top.
- H. Doors: Fabricate from a single piece 1/2 inch HDPE plastic.
 1. Doors and Frame: 1/2 inch thick HDPE plastic with matte texture finish with cross-hatch mesh pattern.
 2. Handle: ADA/ABA Compliant handle fabricated from injection molded plastic.
 3. Locks: Standard hasp.
 4. Hinges: Continuous piano hinges, .05 inch/18 gauge (0.05 inch) thick type 304 stainless steel fabricated to wrap around edges of door and frame and attached with stainless steel tamper-resistant screws.
 - a. Finish: Powder coated to match color of locker.
 5. Latch Bar: Full-height latch bar constructed of 1/2 inch HDPE plastic secured to locker with stainless steel tamper-resistant screws.
- I. Color: As selected by Architect from manufacturer's full range.
- J. Accessories:
 1. Coat Hooks: Black polycarbonate double hook.
 2. End Panels: 3/8 inch thick, with color and finish matching locker body.
 3. Filler Panels: 1/2 inch HDPE filler panel, with color and finish matching locker body, attached with 3/8 inch thick HDPE solid plastic angle bracket.
 4. Wall Hooks: Black powder coated, cast zinc hook two per locker.
 5. Number Plate: White acrylic with black film coating, laser etched with number specified. Provide one per locker.
 6. Locker Base: 1 inch solid HDPE plastic, with black or finish matching locker body, 4 inch high.
 7. Coat Rod: Schedule 40 PVC with plastic pole sockets and stainless steel tamper-resistant screws.

2.3 LOCKER FABRICATION

- A. Fabricate locker box from a single sheet of HDPE solid plastic with corners fused together. Weld frames and shelves to box assembly. Provide all welded construction of locker parts without dovetail slots or metal fasteners. Add welded gussets in single tier full height lockers.
- B. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.
- C. Hardware Attachment: All hinges, handles, hasps, hooks, latch bars, and locks attached with tamper-resistant screws.
- D. Provide ventilated panels where indicated.
- E. Continuous Base: Set toe clearance 3 inch from locker front. Notch end caps for ease of installation.
- F. Filler Panels: Fabricated in unequal leg angle shape; finished to match lockers.

- G. Finished End Panels: Fabricated with 3/8 inch wide edge dimension, configured to conceal fasteners and holes at exposed ends of plastic lockers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install lockers in climate controlled environment, shielded from direct sunlight.
- B. General: Install on floor or other firm support. Install level, plumb, and true.
 - 1. Position locker base per approved shop drawing. Using fasteners provided by manufacturer, anchor base sections to the floor.
 - 2. Attach filler pieces to lockers with male-female sex bolts.
 - 3. Position first locker according to submittal layout. Square and plumb the locker using concealed shims. Secure the locker to the wall at the top and bottom of the locker. Position second locker next to first, square and plumb to align the tops and bottoms; and temporarily clamp lockers together. Drill four holes through the sides of the lockers and connect lockers using sex bolts provided by manufacturer.
- C. Accessories: Fit exposed connections of trim, fillers, and closures together to form tight, hairline joints, with concealed fasteners and splice plates furnished by locker manufacturer. Install as indicated on approved shop drawings.
 - 1. Coat Hooks: Attach with at least two fasteners.
 - 2. Coat Rods: Attach at height indicated.
 - 3. Identification Plates: Identify plastic lockers with approved identification numbers. Attach plates to each locker door.
 - 4. Filler Panels: Attach with concealed fasteners.
 - 5. Finished End Panels: Attach at ends indicated.

3.2 FINAL CLEANING

- A. Clean locker interior and exterior surfaces.
- B. Remove packaging and construction debris and legally dispose of off-site.

END OF SECTION 10 5126

SECTION 10 5143 - WIRE MESH STORAGE LOCKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes wire mesh storage lockers.

1.3 REFERENCE STANDARDS

- A. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.

1.4 DEFINITIONS

- A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments.
- C. Samples: For units with factory-applied color finishes.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire mesh storage lockers palletized to provide protection during transit and Project-site storage. Use vented plastic.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh storage lockers by field measurements before fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Geargrid Wall Mount Lockers or comparable product by one of the following:
 - 1. GearGrid - Basis of Design
 - 2. ReadyRack - Red Rack.

2.2 WIRE MESH STORAGE LOCKERS

- A. Unit Sizes: As indicated on Drawings
- B. Mesh: 0.25 inch diameter, intermediate crimp steel wire woven into 3 inch square mesh.
- C. Wall Panels: 1-1/4 inch steel tube framing on top bottom and sides with wire mesh welded to frame.
- D. Tops and Bottoms: Fabricated from same mesh and framing as wall panels.
- E. Horizontal Dividers/Shelves: Fabricated from same wire mesh of wall panels. Shelves shall be adjustable in 3 inch increments.
- F. Finish for Uncoated Ferrous Steel: Powder-coated finish unless otherwise indicated.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. General: Fabricate wire mesh storage lockers from components of sizes not less than those indicated. Use larger size components as recommended by wire mesh manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.
 - 1. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.

2.4 STEEL AND IRON FINISHES

- A. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils (0 inch).
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where wire mesh storage lockers will be installed.
- C. Examine walls to which wire mesh storage lockers will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRE MESH STORAGE LOCKERS ERECTION

- A. Anchor wire mesh storage lockers to walls with manufacturers standard brackets at spacign recommended by manufacturer.
 - 1. Fore concrete and solid masonry anchorage, use expansion anchors.
 - 2. For hollow masonry, use toggle bolts.
- B. Attach adjacent wire mesh storage lockers to each other through side panel framing.
- C. Install horizontal dividers/shelving in double-tier storage lockers.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 10 5143

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SECTION 11 3013 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Kitchen appliances.
- B. Laundry appliances.

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

- A. ICC (IMC)-2021 - International Mechanical Code.
- B. ICC (IRC)-2021 - International Residential Code for One- and Two-Family Dwellings.
- C. UL (DIR) - Online Certifications Directory.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).
- C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.6 COORDINATION

- A. Coordinate utility requirements of appliances prior to wall closure.

1.7 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.
- D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refrigerator/Freezer, Type EQ1: Free-standing; french door with bottom-mounted freezer style.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 - 2. Dimensions (Nominal):
 - a. Width: 36 inches.
 - b. Depth: 26 inches.
 - c. Height: 70 inches.
 - 3. Capacity: Total minimum storage of 19.9 cubic ft; minimum 6.5 cubic ft freezer capacity.
 - 4. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
 - 5. Features: Include glass shelves, built-in water filtration system, and automatic icemaker .
 - 6. Exterior Finish: Stainless steel.
- C. Range, Type EQ2: Dual fuel/gas, free-standing, with standard burners and removable drip pans.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 - 2. Size (Nominal):
 - a. Width: 36 inches.
 - 3. Oven: Single oven compartment. .
 - 4. Burners: Six (6).
 - 5. Controls: Push to turn knobs.
 - 6. Features: Include oven door window.
 - 7. Exterior Finish: Stainless steel.
- D. Wall Oven, Type EQ-3: Electric, double oven.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 - 2. Size: 30 inches wide.
 - 3. Oven: Self-cleaning with electronic ignition.
 - 4. Controls: Solid state electronic.

5. Features: Include automatic meat thermometer, storage drawer, oven door window, broiler pan and grid, oven light, and ____.
 6. Exterior Finish: Porcelain enameled steel, color as indicated.
- E. Cooking Exhaust, Type EQ6: Range hood.
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 2. Size: 36 inches wide.
 3. Fan: Multi-speed, 500 cfm
 4. Exhaust: Rectangular, vented to exterior.
 5. Features: Include cooktop light, night light, and removable grease filter.
 6. Exterior Finish: Stainless steel.
- F. Microwave, Type EQ9: Countertop.
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 2. Capacity: 1.6 cubic ft.
 3. Power: 1200 watts.
 4. Features: Include turntable.
 5. Exterior Finish: Stainless steel.
- G. Dishwasher, Type EQ4: Undercounter.
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 2. Dimensions (Nominal):
 - a. Width: 24 inches.
 - b. Depth: 24 inches.
 - c. Height: 34 inches.
 3. Controls: Solid state electronic.
 4. Sound Level: Maximum 40 dB.
 5. Features: Include rinse aid dispenser and adjustable upper rack.
 6. Exterior Finish: Stainless steel.
- H. Ice makers, Type EQ11: Undercounter
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 2. Dimensions (Nominal):
 - a. Width: 15 inches.
 - b. Depth: 24 inches.
 - c. Height: 34 inches.
 3. Capacity: Not less than 55 lbs in a 24 hour period.
 4. Water Filter: Provide water filter system as recommended by manufacturer.
 5. Exterior Finish: Stainless steel.

2.2 LAUNDRY APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Single Unit Wash Tower, Type EQ5: Front-loading.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated within the drawings.
 - 2. Size (Nominal):
 - a. Width: 27 inches.
 - b. Depth: 30 inches.
 - c. Height: 80 inches.
 - 3. Capacity: Large capacity.
 - 4. Controls: Solid state electronic.
 - 5. Exterior Finish: Porcelain enameled steel.
 - a. Color: Black.

2.3 ACCESSORIES

- A. Dryer Vent Assembly: Comply with ICC (IMC)-2021 and ICC (IRC)-2021.
 - 1. Recessed Dryer Hose Receptacle: 22-gauge, 0.0299-inch aluminized steel receptacle recessed within partition, 12-1/2 inches wide by 21 inches tall, 3-1/2 inches deep, upward exhaust direction.
 - 2. Label: Where exhaust duct length exceeds 35 feet, provide label or tag identifying duct length. Locate label or tag within 6 feet of duct connection.
 - 3. Finish for Exposed Metals: Mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.
- B. Examine substrates, areas, and conditions for compliance with requirements of appliance's operational clearances, maintenance clearances, surface tolerances, and anchorages. Provide written report when conditions are not in compliance with manufacturer's written requirements.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Anchor built-in equipment in place with concealed fasteners.
- C. Freestanding equipment: Place units in final locations after finishes have been completed.
 - 1. Install anti-tip devices according manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.4 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION 11 3013

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SECTION 11 3016 - FIRE SERVICE APPLIANCES

GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Laundry appliances

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Sample Warranties: For manufacturers' special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.7 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.
- B. Laundry Equipment: Limited warranty, including parts and labor for first year and parts thereafter for on-site service on the product.
 1. Warranty Period: Three years from date of Substantial Completion.

PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.
- C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 FIRE SERVICE LAUNDRY EQUIPMENT

- A. Extractor
 1. Basis of Design Product: Subject to compliance with requirements, provide UniMac model UW065 Touch, or comparable product by another manufacturer.
 2. Product Requirements:
 - a. Construction and Cover Panels: 304 or equal stainless steel cylinder, tub.
 - b. Input Voltage: 200-240/60/3; Coordinate electrical requirements with drawings prior to purchasing equipment.
 - c. Dry Weight Capacity: 65 lbs.
 - d. Wash Cylinder Volume: 9.61 cu. ft. minimum.
 - e. Overall Width: Approximately 34.12 inches
 - f. Overall Height: Approximately 64.63 inches
 - g. Overall Depth: Approximately 49.83 inches.
 - h. Number and Size of Water Connections: Four with $\frac{3}{4}$ inch NH male.
 - i. Number and Size of Drain Outlets: One at 3 inches.
 - j. Overflow: Internally plumbed.
 - k. Control System: Programmable microprocessor.
 - l. Cylinder drive: Single motor, 5 hp with inverter drive, capable of 470 RPM through direct drive poly V belt.
 3. Performance Requirements:
 - a. Number of Selectable Wash Speeds: Two
 - b. Number of Extract Speeds: One
 - c. G-force at Highest Extract Speed: 100
 - d. Chemical Supply System: Automatic flushing with connections for 5 external supply lines and control signals for external supplies.
 - e. Through the door jet-spray rinse system.

- f. Control System:
 - 1) Programmable microprocessor; manual keypad, Windows PDA or PC)
 - 2) 41 cycle capability with graphic display of words or icons.
 - 3) PC software interface with laundry management reports, network capability.
 - 4) Real-time clock allows time/date stamp of 100+ items; maintenance reminder.
 - 5) 30 programmable water levels.
 - 6) Temperature controlled fill value, slow drain and automatic leak detection system.
 - 7) Diagnostic capabilities.
- g. Drain valve automatically opens in the event of power failure.

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.

EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 DEMONSTRATION

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

END OF SECTION 11 3016

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, single-roller shades.
- B. Related Requirements:
 - 1. Section 06 61053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 07 9200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- C. WCMA A100.1 - Standard for Safety of Window Covering Products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two ???Insert number??? units.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. 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 its intended use.
- B. 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.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

- A. Basis of Design Product: Subject to compliance with requirements provide Mechosahde Systems LLC, Mecho/5x or comparable product by another manufacture
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Stainless steel .
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.

- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of interior face of shade.
 - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method .
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
 - 1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.
 - 2. Endcap Covers: To cover exposed endcaps.
 - 3. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
 - 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: PVC-coated polyester.
 - 3. Weave: Basketweave.
 - 4. Thickness: 0.022 inches.
 - 5. Weight: 13.57 oz./sq. yd..
 - 6. Orientation on Shadeband: Railroaded.
 - 7. Openness Factor: 3 percent.
 - 8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees Fahrenheit:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. 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.
 - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 2413

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SECTION 12 3661.16 - SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard.
- B. AWI/AWMAC/WI - Architectural Woodwork Standards, 2nd Edition.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide solid surface materials as manufactured by Corian, of colors and patterns indicated, or comparable product by one of the following:
 - a. Avonite Surfaces.
 - b. Formica Corporation.
 - c. LG Chemical, Ltd.
 - d. Samsung Chemical USA, Inc.
 - e. Wilsonart International Holdings, Inc.
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
 - 3. Colors and Patterns: As indicated by manufacturer's designations.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Premium.
- B. Configuration:
 - 1. Front: Straight, slightly eased at top.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. End Splash: Matching backsplash.
- C. Countertops: 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.
- E. Joints: Fabricate countertops without joints.
- F. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- F. Install aprons to backing and countertops with adhesive.

- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.16

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SECTION 12 3661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard.
- B. AWI/AWMAC/WI - Architectural Woodwork Standards, 2nd Edition.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Quartz agglomerate countertops.
 - 2. Quartz agglomerate backsplashes.
 - 3. Quartz agglomerate end splashes.

1.4 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.
 - 2. Wood trim, 8 inches long.
 - 3. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Cambria.
 - b. Cosentino USA.
 - c. E. I. du Pont de Nemours and Company.
 - d. LG Chemical, Ltd.
 - e. Meganite Inc.
 - f. Samsung Chemical USA, Inc.
 - g. Technistone USA, Inc.
 - h. Transolid Div of Trumbull Industries.
 - 2. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Premium.
- B. Configuration:
 - 1. Front: Straight, slightly eased at top.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. End Splash: Matching backsplash.
- C. Countertops: 3/4-inch- (19-mm-) thick, quartz agglomerate with front edge built up with same material.

- D. Backsplashes: 1/2-inch- (12.7-mm-) thick, quartz agglomerate.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - b. Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
 - c. Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch into fixture opening.
 - 2. 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.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
 - 4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

- B. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- E. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.19

SECTION 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Above ground piping.
- B. Buried piping.
- C. Escutcheons.
- D. Mechanical couplings.
- E. Pipe hangers and supports.
- F. Pipe sleeves.

1.2 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings; 2018.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
- G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2018.
- H. ASME B16.11 - Forged Fittings, Socket-welding and Threaded; 2016 (Errata 2017).
- I. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- J. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- K. ASME B16.25 - Buttwelding Ends; 2012.
- L. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2018.
- M. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

- N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- O. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).
- P. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2018a.
- Q. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- R. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2013.
- S. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- U. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- V. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.
- W. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- X. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017.
- Y. AWWA C606 - Grooved and Shouldered Joints; 2015.
- Z. FM (AG) - FM Approval Guide; current edition.
- AA. ITS (DIR) - Directory of Listed Products; current edition.
- BB. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- CC. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2016.
- DD. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.
- C. Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
 - 1. Comply with NFPA 13.
 - 2. See Section 21 1300.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 BURIED PIPING

- A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.25, butt weld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
3. Joints: Welded in accordance with AWS D1.1/D1.1M.
4. Casing: Closed glass cell insulation.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110/A21.10, standard thickness.
2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.

1. Steel Fittings: ASME B16.9 wrought steel, butt welded, ASME B16.25 butt weld ends, ASTM A234/A234M wrought carbon steel or alloy steel, ASME B16.5 steel flanges and fittings, or ASME B16.11 forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.4 PIPE SLEEVES

- A. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- B. Pipe Passing Through Below Grade Exterior Walls:
 1. Zinc-coated or cast-iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

- C. Not required for wall hydrants for fire department connections or in drywall construction.
- D. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 - 3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.5 ESCUTCHEONS

- A. Material:
 - 1. Metals and Finish: Comply with ASME A112.18.1.
- B. Construction:
 - 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.6 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.7 MECHANICAL COUPLINGS

- A. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig.

3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 2. Place hangers within 12 inches of each horizontal elbow.
 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

- H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- I. Do not penetrate building structural members unless indicated.
- J. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- K. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a watertight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- L. Escutcheons:
 - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.3 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 21 0500

SECTION 21 0548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration isolators.
- D. External seismic snubber assemblies.
- E. Seismic restraint systems

1.2 DEFINITIONS

- A. Fire Suppression Component: Where referenced in this section in regards to seismic controls, applies to any portion of the fire suppression system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- H. FM 1950 - Seismic Sway Braces for Automatic Sprinkler Systems; 2010.

- I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).
- K. MFMA-4 - Metal Framing Standards Publication; 2004.
- L. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
- N. UL 203A - Standard for Sway Brace Devices for Sprinkler System Piping; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
- 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
- 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
- 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
- 5. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

- 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 SUBMITTALS

- A. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- C. Shop Drawings - Seismic Controls:
 - 1. Include dimensioned plan views and sections indicating proposed fire suppression component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 - 2. Identify mounting conditions required for equipment seismic qualification.
 - 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 - 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 - 6. Indicate locations of seismic separations where applicable.
- D. Seismic Design Data:
 - 1. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Manufacturer's detailed field testing and inspection procedures.

1.6 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in Pennsylvania and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing fire suppression equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 1. Select vibration isolators to provide required static deflection.
 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.2 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide fire suppression component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor fire suppression components.
- B. Seismic Design Criteria: As indicated on drawings.
- C. Component Importance Factor (Ip): Fire suppression components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.
- D. Seismic Qualification of Equipment:
 1. Provide special certification for fire suppression equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.

3. Notify DEDC, LLC and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for fire suppression components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions, All Seismic Design Categories:
 - a. Fire Suppression Piping Exemptions, All Seismic Design Categories:
 - 1) Lateral sway bracing for piping individually supported within 6 inches of the structure measured between the top of pipe and the point of attachment to the structure, where all conditions for exception specified in NFPA 13 are met.
 - 2) Lateral sway bracing for branch lines smaller than 2-1/2 inches in diameter, where branch line restraint is provided in accordance with NFPA 13.
3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
 - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

6. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
 - a. Arrange restraint elements to avoid obstruction of sprinklers in accordance with NFPA 13.
 - b. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - c. Use only cable restraints to restrain vibration-isolated fire suppression components.
 - d. Use only one restraint system type for a given fire suppression component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - e. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain fire suppression component in all lateral directions; consider bracket geometry in anchor load calculations.
 - f. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported fire suppression component weight.
 - g. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported fire suppression component weight.
 - h. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
 - i. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
 - j. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

F. Seismic Attachments:

1. Comply with support and attachment requirements of NFPA 13.

2. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 3. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 4. Do not use power-actuated fasteners.
 5. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps, but not for sway bracing attachments as prohibited by NFPA 13.
 6. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 7. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.
- G. Seismic Interactions:
1. Include provisions to prevent seismic impact between fire suppression components and other structural or nonstructural components.
 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
 3. Comply with minimum clearance requirements between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.
- H. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections, in accordance with NFPA 13, to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.

- d. Anticipated drifts between floors.
- 2. Provide clearance around fire suppression system piping extending through walls, floors, platforms, and foundations in accordance with NFPA 13.

2.3 VIBRATION ISOLATORS

A. Manufacturers:

- 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com.
 - b. Mason Industries; None - N/A: www.mason-ind.com.
 - c. Vibration Eliminator Company, Inc; None - N/A: www.veco-nyc.com.

B. General Requirements:

- 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
- 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
- 3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Seismic Applications:

- 1. Resilient Material Isolator Mounts, Seismic:

- a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.4 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

- A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- B. Seismic Snubbing Elements:
 - 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.5 SEISMIC RESTRAINT SYSTEMS

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Where required by NFPA 13, provide products listed as complying with UL 203A or FM 1950.
- C. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 2. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 5. Adjust isolators to be free of isolation short circuits during normal operation.
 - 6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- F. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:

- a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
- 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
- 6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.
 - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
 - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
 - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.3 FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- C. Seismic Controls:
 - 1. Verify snubbing element air gaps.

- D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 21 0548

SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
- E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags.
- B. Control Panels: Nameplates.
- C. Instrumentation: Tags.
- D. Major Control Components: Nameplates.
- E. Piping: Tags.
- F. Pumps: Nameplates.

- G. Relays: Tags.
- H. Small-sized Equipment: Tags.
- I. Thermostats: Nameplates.
- J. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Thickness: 1/8 inch.
 - 5. Plastic: Comply with ASTM D709.

2.3 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 - 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
 - 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
- B. Paint for Stencils: As specified in Section 09 9123, semi-gloss enamel, colors complying with ASME A13.1.

2.5 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- E. Color code as follows:
 - 1. Fire Quenching Fluids: Red with white letters.

2.6 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 9123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 21 0553

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.
- C. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
- D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.3 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.
- F. ITS (DIR) - Directory of Listed Products; current edition.
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 1963 - Standard for Fire Hose Connections; 2014.
- I. UL (DIR) - Online Certifications Directory; Current Edition.
- J. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to DEDC, LLC.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.

1.6 QUALITY ASSURANCE

- A. Comply with FM (AG) requirements.
- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer or NICET Level III designer experienced in design of this type of work and licensed in the State of Maryland.
- C. Equipment and Components: Provide products that bear FM (AG) label or marking.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 - 2. Viking Corporation: www.vikinggroupinc.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. UL Listed for Fire Protection Services

2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Interface system with building fire and smoke alarm system.
- C. Provide fire department connections where indicated.
- D. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3 SPRINKLERS

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Finish: Brass.
 - 3. Escutcheon Plate Finish: Antique Brass.
- B. Exposed Area Type: Standard upright type with guard (where sprinkler is lower than seven feet above finished floor)
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.

2. Coverage Type: Standard.
 3. Finish: Brass.
 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Storage Sprinklers: Pendant type with guard.
1. Response Type: Standard.
 2. Coverage Type: Standard.
 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Guards: Finish to match sprinkler finish.
- F. Flexible Drop System: Stainless steel, multiple use, open gate type.
1. Application: Use to properly locate sprinkler heads.
 2. Include all supports and bracing.
 3. Provide braided type tube as required for the application.

2.4 PIPING SPECIALTIES

- A. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- B. Test Connections:
1. Inspector's Test Connection:
 - a. AGF Test and Drain or equal. Drain outside of building.
 2. Backflow Preventer Test Connection:
 - a. Furnish one valve for each 250 gpm of system demand or fraction thereof.
 - b. Provide permanent sign reading "Test Valve" in accordance with Section 21 0553.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Connections:
1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.

- a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
- b. Configuration: Horizontal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.
- F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- G. Flush entire piping system of foreign matter.
- H. Install guards on sprinklers in exposed ceilings where less than seven feet above finished floor..
- I. Hydrostatically test entire system.
- J. Require test be witnessed by Fire Marshal.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

3.3 SCHEDULES

- A. System Hazard Areas: As indicated on Drawings

END OF SECTION 21 1300

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Plumbing demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 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.
 - a. Electrical Characteristics for Plumbing 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.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.
5. 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.
 - d. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - e. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - f. 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.

2.3 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. 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.

2.4 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.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 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. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 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.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install plumbing 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.

3.5 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 as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.
- D. ERECTION OF WOOD SUPPORTS AND ANCHORAGES
- E. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
 - 1. 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.

2. Attach to substrates as required to support applied loads.

3.7 GROUTING

- A. Mix and install grout for plumbing 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.

CURE PLACED GROUT. END OF SECTION 220500 22 0500

SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.2 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.
- B. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Design Data: Indicate selection calculations.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Packing for Packed Expansion Joints: One set for each joint.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company; _____: www.metraflex.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Carbon steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:

1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.

2. The Metraflex Company; _____: www.metraflex.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

- D. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION 22 0516

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Iron, single-flange butterfly valves.
 - 4. Iron, grooved-end butterfly valves.
 - 5. Bronze lift check valves.
 - 6. Bronze swing check valves.
 - 7. Iron swing check valves.
 - 8. Iron, grooved-end swing check valves.
 - 9. Bronze gate valves.
 - 10. Bronze globe valves.
 - 11. Chainwheels.

1.3 RELATED SECTIONS:

- A. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
- B. Section 221113 "Facility Water Distribution Piping" for valves applicable only to this piping.
- C. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
- D. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

1.4 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.

- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
 - 4. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.

2. STORE VALVES INDOORS AND MAINTAIN AT HIGHER THAN AMBIENT DEW POINT TEMPERATURE. IF OUTDOOR STORAGE IS NECESSARY, STORE VALVES OFF THE GROUND IN WATERTIGHT ENCLOSURES
3. USE SLING TO HANDLE LARGE VALVES; RIG SLING TO AVOID DAMAGE TO EXPOSED PARTS. DO NOT USE HANDWHEELS OR STEMS AS LIFTING OR RIGGING POINTS

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valves shall be American made.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Actuator Types:
 1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 2. Handwheel: For valves other than quarter-turn types.
 3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller[except plug valves].
 4. Wrench: For plug valves with square heads. Furnish Cleveland Clinic with 1 wrench for every [5] [10] plug valves, for each size square plug-valve head.
 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- F. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 1. Gate Valves: With rising stem.
 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: With extended neck.
- G. Valve-End Connections:
 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.

3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hammond Valve.
- b. Milwaukee Valve Company.
- c. Mueller.
- d. Watts.
- e. Conbraco Industries, Inc.; Apollo Valves.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa).
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

B. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hammond Valve.

- b. Milwaukee Valve Company.
- c. Mueller
- d. Watts.
- e. Conbraco Industries, Inc.; Apollo Valves.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa).
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

C. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.

- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

D. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller.
 - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.

- b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).

- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. Red-White Valve Corporation.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Center Line.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty; a division of SPX Corporation.

- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I, API 609.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2" through 12" without use of downstream flange. Field replaceable hard phenolic backed liner.
 - d. Stem: One- or two-piece 416 stainless steel.
 - e. Disc: Aluminum bronze.
- B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Center Line.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty; a division of SPX Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I, API 609.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2" through 12" without use of downstream flange. Field replaceable hard phenolic backed liner.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: NBR.
 - f. Stem: One- or two-piece 416 stainless steel.

- g. Disc: Nickel-plated[or -coated] ductile iron.
- C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty; a division of SPX Corporation.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2" through 12" without use of downstream flange. Field replaceable hard phenolic backed liner.
 - d. Stem: One- or two-piece stainless steel.
 - e. Disc: Stainless steel.
- D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.

- f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty; a division of SPX Corporation.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2" through 12" without use of downstream flange. Field replaceable hard phenolic backed cartridge.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: NBR.
 - f. Stem: One- or two-piece 416 stainless steel.
 - g. Disc: Stainless steel.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.
 - e. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig (1200 kPa).
 - c. Body Material: Coated, ductile iron.

- d. Stem: Two-piece stainless steel.
- e. Disc: Coated, ductile iron.
- f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. Shurjoint Piping Products.
 - e. Tyco Fire Products LP; Grinnell Mechanical Products.
 - f. Victaulic Company.
 - g. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
 - c. NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
 - d. Body Material: Coated, ductile iron.
 - e. Stem: Two-piece stainless steel.
 - f. Disc: Coated, ductile iron.
 - g. Seal: EPDM.

2.6 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.

- c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Conbraco Industries, Inc.; Apollo Valves.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Lift Check Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flo Fab Inc.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. Mueller Steam Specialty; a division of SPX Corporation.
 - f. Red-White Valve Corporation.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Conbraco Industries, Inc.; Apollo Valves.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.

- f. Disc: NBR, PTFE, or TFE.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. Red-White Valve Corporation.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Conbraco Industries, Inc.; Apollo Valves
 - i. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Milwaukee Valve Company.

- e. Red-White Valve Corporation.
- f. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Legend Valve.
 - f. Milwaukee Valve Company.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.

- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Conbraco Industries, Inc.; Apollo Valves.
- 2. Description
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE or TFE.
 - j. Gasket: Asbestos free.

2.9 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Shurjoint Piping Products.

- c. Tyco Fire Products LP; Grinnell Mechanical Products.
- d. Victaulic Company.
- 2. Description:
 - a. CWP Rating: 300 psig (2070 kPa).
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring-operated, ductile iron or stainless steel.

2.10 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Conbraco Industries, Inc.; Apollo Valves.
 - j. Standard: MSS SP-80, Type 1.
 - k. CWP Rating: 200 psig (1380 kPa).
 - l. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - m. Ends: Threaded[or solder joint].
 - n. Stem: Bronze.
 - o. Disc: Solid wedge; bronze.

- p. Packing: Asbestos free.
- q. Handwheel: Malleable iron[, bronze, or aluminum].
- 2. Class 125, RS Bronze Gate Valves:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 3) Crane Co.; Crane Valve Group; Stockham Division.
 - 4) Hammond Valve.
 - 5) Milwaukee Valve Company.
 - 6) Powell Valves.
 - 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 8) Conbraco Industries, Inc.; Apollo Valves.
 - 9) Description:
 - (a) Standard: MSS SP-80, Type 2.
 - (b) CWP Rating: 200 psig (1380 kPa).
 - (c) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - (d) Ends: Threaded[or solder joint].
 - (e) Stem: Bronze.
 - (f) Disc: Solid wedge; bronze.
 - (g) Packing: Asbestos free.
 - (h) Handwheel: Malleable iron[, bronze, or aluminum].
- 3. Class 150, NRS Bronze Gate Valves:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hammond Valve.

- 2) Milwaukee Valve Company.
- 3) Red-White Valve Corporation.
- 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 5) Conbraco Industries, Inc.; Apollo Valves.
- 6) Description:
 - (a) Standard: MSS SP-80, Type 1.
 - (b) CWP Rating: 300 psig (2070 kPa).
 - (c) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - (d) Ends: Threaded.
 - (e) Stem: Bronze.
 - (f) Disc: Solid wedge; bronze.
 - (g) Packing: Asbestos free.
 - (h) Handwheel: Malleable iron[, bronze, or aluminum].
4. Class 150, RS Bronze Gate Valves:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Crane Co.; Crane Valve Group; Stockham Division.
 - 3) Hammond Valve.
 - 4) Milwaukee Valve Company.
 - 5) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 6) Conbraco Industries, Inc.; Apollo Valves.
 - 7) Description:
 - (a) Standard: MSS SP-80, Type 2.
 - (b) CWP Rating: 300 psig (2070 kPa).
 - (c) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.

- (d) Ends: Threaded.
- (e) Stem: Bronze.
- (f) Disc: Solid wedge; bronze.
- (g) Packing: Asbestos free.
- (h) Handwheel: Malleable iron[, bronze, or aluminum].

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. Red-White Valve Corporation.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded[or solder joint].
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron[, bronze, or aluminum].

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Red-White Valve Corporation.
 - d. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
- a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded[or solder joint].
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron[, bronze, or aluminum].

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. Red-White Valve Corporation.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
- a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.

- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron[, bronze, or aluminum].

2.12 CHAINWHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babbitt Steam Specialty Co.
 - 2. Roto Hammer Industries.
 - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to [ball] [butterfly] [and] [plug] valve stems.
 - 3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
 - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for [ball] [butterfly] [gate] [and] [globe] valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball with memory stop, circuit setter, or flow control valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with [bronze] [or] [nonmetallic] disc.
 - b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Brass swing check valves with lever and weight or with spring or iron, center-guided, [metal] [or] [resilient]-seat check valves.
 - c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

- C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
 7. For Grooved-End [Copper Tubing] [and] [Steel Piping]: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 4 (DN 100) and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Bronze Angle Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
 3. Ball Valves: [Two] [Three] piece, full port, bronze with brass trim.
 4. Bronze Swing Check Valves: [Class 125], [bronze] [nonmetallic] disc.
 5. Bronze Globe Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
- B. Pipe NPS 6 (DN 150) and Larger:
1. Iron, Single-Flange Butterfly Valves: 200 CWP, [EPDM] [NBR] seat, [aluminum- bronze] [ductile-iron] [stainless-steel] disc.
 2. Iron, Grooved-End Butterfly Valves: 300 CWP.
 3. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
 4. Iron, Grooved-End Swing Check Valves: 300 CWP.

3.6 [SANITARY-WASTE] [AND] [STORM-DRAINAGE] VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
1. Bronze[and Brass] Valves: May be provided with solder-joint ends instead of threaded ends.

2. Bronze Angle Valves: [Class 125] [Class 150], [bronze] [nonmetallic] [stainless-steel] disc.
 3. Ball Valves: [Two] [Three] piece, full port, [brass] [or] [bronze] with [brass] [bronze] [stainless-steel] trim.
 4. Bronze Swing Check Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
 5. Bronze Gate Valves: [Class 125] [Class 150], [NRS] [RS].
 6. Bronze Globe Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
 7. Pipe NPS 2-1/2 (DN 65) and Larger:
- B. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
1. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
 2. Iron, Grooved-End Swing Check Valves: 300 CWP.

END OF SECTION 220523 22 0523

SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Seismic control requirements.
- B. Vibration-isolated equipment support bases.
- C. Vibration isolators.
- D. External seismic snubber assemblies.
- E. Seismic restraint systems.
- F. Vibration-isolated and/or seismically engineered roof curbs.
- G. Inertia bases.
- H. Vibration isolators.

1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
- C. Section 23 0548.01 - Vibration and Seismic Controls for HVAC.

1.3 DEFINITIONS

- A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- H. MFMA-4 - Metal Framing Standards Publication; 2004.
- I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
- 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
- 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
- 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
- 5. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

- 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.6 SUBMITTALS

- A. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- C. Shop Drawings - Vibration Isolation Systems:
 - 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 - 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- D. Shop Drawings - Seismic Controls:
 - 1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 - 2. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 3. Indicate proposed arrangement of distributed system trapeze support groupings.
 - 4. Indicate proposed locations for distributed system flexible fittings and/or connections.
 - 5. Indicate locations of seismic separations where applicable.
- E. Seismic Design Data:
 - 1. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- F. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

1.7 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in Pennsylvania and with minimum five years experience designing seismic restraints for nonstructural components.
 - 1. Designer may be employed by the manufacturer of the seismic restraint products.

- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.
- B. Seismic Design Criteria: As indicated on drawings.
- C. Component Importance Factor (Ip): Plumbing components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
 - 1. Plumbing components required to function for life safety purposes after an earthquake.
 - 2. Plumbing components that support or otherwise contain hazardous substances.
- D. Seismic Restraints:
 - 1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Seismic Restraint Exemptions:
 - a. Exemptions for Seismic Design Category C:
 - 1) Plumbing components where either of the following apply:
 - (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
 - (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
 - 2) Plumbing piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).

- b. Exemptions for Seismic Design Category D, E, and F:
 - 1) Discrete plumbing components that are positively attached to the structure where either of the following apply:
 - (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (I_p) is 1.0.
 - (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
 - 2) Plumbing piping with component importance factor (I_p) of 1.0 and nominal pipe size of 3 inch or less, or with component importance factor (I_p) of 1.5 and nominal pipe size of 1 inch or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
- c. Plumbing Piping Exemptions, All Seismic Design Categories:
 - 1) Plumbing piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:
 - (a) Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet size requirements for exemption as single pipes described under specific seismic design category exemptions above.
 - (b) Trapeze supported piping with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (I_p) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.
 - (c) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (I_p) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 200 pounds or less.

- (d) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.
 - (e) Hanger supported piping with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, where pipe has a component importance factor (Ip) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds or less.
- 3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
- 4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
- 5. Seismic Type Vibration Isolators:
 - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
- 6. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

7. Seismic Restraint Systems:

- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
- b. Use only cable restraints to restrain vibration-isolated plumbing components, including distributed systems.
- c. Use only one restraint system type for a given plumbing component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
- d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.
- e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported plumbing component weight.
- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

E. Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

F. Seismic Interactions:

1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

G. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.

2.2 MANUFACTURERS

- A. Isolation Technology, Inc: www.isolationtech.com.

2.3 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:

1. Vibration-Isolated Equipment Support Bases:
 - a. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com/#sle.
 - b. Mason Industries; None - N/A: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc; None - N/A: www.veco-nyc.com/#sle.

2.4 VIBRATION ISOLATORS

A. Manufacturers:

1. Vibration Isolators:

- a. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com/#sle.
- b. Mason Industries; None - N/A: www.mason-ind.com/#sle.
- c. Vibration Eliminator Company, Inc; None - N/A: www.veco-nyc.com/#sle.

B. General Requirements:

- 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
- 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
- 3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Seismic Applications:

- 1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
- 2. Restrained Spring Isolators, Seismic:

- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.5 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

1. External Seismic Snubber Assemblies:

- a. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com/#sle.
 - b. Mason Industries; None - N/A: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc; None - N/A: www.veco-nyc.com/#sle.
- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- C. Seismic Snubbing Elements:
1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.6 SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
1. Seismic Restraint Systems:
 - a. Eaton Corporation; None - N/A: www.eaton.com/#sle.
 - b. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com/#sle.
 - c. Mason Industries; None - N/A: www.mason-ind.com/#sle.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
1. Comply with ASCE 19.
 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.7 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:

1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
 - a. Kinetics Noise Control, Inc; None - N/A: www.kineticsnoise.com/#sle.
 - b. Mason Industries; None - N/A: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc; None - N/A: www.veco-nyc.com/#sle.

B. Vibration Isolation Curbs:

1. Seismic Curb:
 - a. Location: Between structure and rooftop equipment.
 - b. Construction: Steel.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
 - e. Weather exposed components consist of corrosion resistant materials.

2.8 INERTIA BASES

A. Structural Bases:

1. Construction: Welded structural steel with gusseted brackets, to support equipment and motor, with motor slide rails.
2. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

B. Concrete Inertia Bases:

1. Construction: Structural steel channel perimeter frame, with gusseted brackets and anchor bolts, reinforcing; concrete filled.
2. Mass: Minimum of 1.5 times weight of isolated equipment.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Minimum 3000 psi concrete.

2.9 VIBRATION ISOLATORS

A. Restrained Open Spring Isolators:

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
4. Restraint: Provide heavy mounting frame and limit stops.

B. Spring Hanger:

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
3. Misalignment: Capable of 20 degree hanger rod misalignment.

C. Neoprene Pad Isolators:

1. Rubber or neoprene waffle pads.
 - a. Hardness: 30 durometer.
 - b. Thickness: Minimum 1/2 inch.
 - c. Maximum Loading: 50 psi.
 - d. Rib Height: Maximum 0.7 times width.
2. Configuration: Single layer.
3. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 - 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
 - 6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.

- c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
- d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 22 0548

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Air Terminal Units: Tags.
- B. Dampers: Ceiling tacks, where located above lay-in ceiling.
- C. Major Control Components: Nameplates.
- D. Piping: Tags.
- E. Pumps: Nameplates.
- F. Tanks: Nameplates.
- G. Thermostats: Nameplates.
- H. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.

2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- D. Color code as follows:
 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
 2. Flammable Fluids: Yellow with black letters.

2.5 CEILING TACKS

- A. Manufacturers:
 1. Craftmark Pipe Markers; _____: www.craftmarkid.com/#sle.
 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Steel with 3/4 inch diameter color coded head.
- C. Color code as follows:
 1. HVAC Equipment: Yellow.
 2. Fire Dampers and Smoke Dampers: Red.
 3. Plumbing Valves: Green.
 4. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 0553

SECTION 22 0719 - PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping system insulation.
2. Equipment insulation.
3. Pipe insulation jackets.
4. Equipment insulation jackets.
5. Insulation accessories including vapor retarders and accessories.

1.2 REQUIREMENTS

- A. All insulation shall have a maximum flame spread index of 25.
- B. All insulation shall have a maximum smoke developed index of 50.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics, flame spread index, smoke developed index and list of materials and thickness for each service, and location.

1.4 CLOSE OUT SUBMITTALS

- A. Not Applicable

1.5 QUALITY ASSURANCE

- A. Insulation shall be installed to provide an impenetrable vapor barrier around the object insulated. The insulation contractor shall fully adhere insulation to all surfaces so that there are no gaps between the insulation and the surface of the object insulated.
- B. Insulation shall not be compressed when installed upon objects. Insulator shall install insulation so that it maintains its original (specified) thickness.
- C. Insulation jacketing must maintain a continuous barrier around insulation. Insulation jacketing that has cuts, rips or breaks will not be accepted.
- D. Insulation jacketing must be clean and having its original reflectivity.
- E. Maintain temperature before, during and after installation for a minimum of 24 hours.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 INSULATION CODE

- A. MAN MADE MINERAL FIBER: Insulation Code PI-1
 - 1. Insulation: ASTM C457, Type I - pipe and tubing insulation
 - a. Temperature ranges 0F to 850F
 - b. 'K' factor: ASTM C177, 0.24 at 75 degrees F
 - c. ASJ Vapor Retarder Jacket
 - d. Moisture Vapor Transmission: 0.002 perm
- B. MAN MADE MINERAL FIBER: Insulation Code PI-2
 - 1. Insulation: ASTM C1393, Type I - semi rigid fibrous glass board, Class 2
 - a. Temperature ranges 0F to 850F
 - b. 'K' factor: ASTM C177, 0.27 at 75 degrees F
 - c. ASJ Vapor Retarder Jacket
 - 1) Moisture Vapor Transmission: 0.002 perm
- C. CELLULAR POLYISOCYANURATE INSULATION: Insulation Code PI-3

1. Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation: ASTM C591, Type III, compressive strength 50 psi
 - a. Temperature ranges -297F to 250F
 - b. 'K' factor: 0.19 at 75 degrees F.
 - c. Fasteners: Fasten with fiber reinforced masking tape. For sized over 6" fasten with 18 gage stainless steel wires over fiber reinforced masking tape.
 - D. ELASTOMERIC CELLULAR FOAM: Insulation Code PI-4
 1. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form.
 2. Elastomeric Foam Adhesive:
 - a. Air dried, contact adhesive, compatible with insulation.
- 2.2 PIPE INSULATION AND EQUIPMENT JACKETS:
- A. PVC Plastic Jacket: Insulation Jacket Code PJ-1
 1. Product Description: Sheet material, WHITE.
 2. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
 - a. Thickness: 30 mil.
 - 1) Connections: Brush on welding adhesive.
 - 2) Compatible with insulation.
 - B. VentureClad: Insulation Jacket Code PJ-2
 1. VentureClad model 1579CW-E insulation jacketing tape with and aluminum stucco embossed finish.
 - a. Stainless Steel Pipe Jacket: Insulation Jacket Code PJ-3
 - 1) ASTM A167 Type 304 stainless steel
 - 2) Thickness: 0.18 inch thick
 - 3) Finish: Smooth
 - 4) Metal Jacket Bands: 3/8" wide; 0.010 inch thick stainless steel

2.3 VALVE INSULATION:

- A. All Domestic water valves shall be insulated per systems insulation requirements.
- B. APPROVED INSULATION MANUFACTURERS:

2.4 ARMSTRONG

- A. Certain-Teed
- B. Dow Chemical
- C. HiTherm
- D. Johns Manville
- E. Owens Corning
- F. Pittsburg Corning
- G. Specialty Products & Insulation
- H. Venture Products

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping and equipment has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Verify field measurements prior to fabrication.
- B. Insulation / Jackets in environmental air plenums shall have 25/50 Flame/Smoke rating
- C. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints:
 - 1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory- applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with fitting covers.

- D. Inserts and Shields:
 - 1. Application: Piping or Equipment
 - 2. Shields: Minimum 12inches Long Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under finish jacket.
 - 4. Inserts (Domestic Cold Water and Rain Water Collectors): Armaflex Ultima (Wood Dowels or Wood Blocking are not allowed)
 - 5. Inserts (Domestic Hot Water): 12" long minimum Calcium Silicate (Wood Dowels or Wood Blocking are not allowed)
- E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent fire stopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.
- F. All vapor barrier and jacket seams shall be located located at 3 or 9 o'clock position on side of horizontal piping and with overlap facing down to shed water or on bottom side of horizontal duct.
- G. Heat Traced Piping: Size insulation large enough to enclose pipe and heat tracer.
- H. Factory Insulated Equipment: Do not insulate.
- I. Exposed Piping and Equipment: Locate insulation and cover seams in least visible locations. Jacketing required on exposed piping.
- J. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- K. Finish insulation at supports, protrusions, and interruptions.
- L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- N. All piping routed interior to the building and in concealed spaces does not require a jacket.
- O. Plumbing insulation in environmental air plenums to have 25/50 flame/smoke rating

3.3 SCHEDULES

- A. Piping insulation required thickness based on fluid temperature and insulation conductivity:

For piping smaller than 1.5 inch and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted, but not to a thickness less than 1 inch.

B. Pipe Insulation Schedule:

1. Piping System / Insulation Code / Jacket Code
 - a. Domestic Hot Water - Interior to Building Exposed / PI-1/ PJ-1 PJ-3*
 - b. Domestic Hot Water - Interior to Building Concealed / PI-1 / None Required
 - c. Domestic Cold Water - Interior to Building Exposed / PI-4 / PJ-1 PJ-3*
 - d. Domestic Cold Water - Interior to Building Concealed / PI-4 / None Required
 - e. Domestic Cold Water - Exterior to Building / PI-3 / PJ-2

* Use stainless steel jacket if room temperature exceeds 120F and where volatile or corrosive chemicals are stored.

END OF SECTION 22 0719

SECTION 22 0719.11 - UNDER-LAVATORY PIPE AND SUPPLY COVERS - PLUMBEREX

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Under-lavatory pipe and supply covers.

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

- A. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.
- B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of covers, sizes, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
 - 1. Fusion Molded Under-Lavatory Insulators (Non-Sewn): Plumberex Handy-Shield Maxx.
 - 2. Slim Fit Under-Lavatory Insulators (Non-Sewn): Plumberex Trap Gear.
 - 3. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.
- B. General:
 - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
 - 2. Adhesives, sewing threads, and two-ply laminated materials are prohibited.
 - 3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
 - 4. Construction: 1/8 inch PVC with antimicrobial, antifungal, and ultraviolet light (UV) resistant properties.
 - a. Comply with ASTM C1822 for covers on accessible lavatory piping.
- C. ASTM E84 Compliant, Under-Lavatory Insulators:
 - 1. Construction: Soft, non-laminated, flexible PVC with antimicrobial, antifungal, and UV-resistant properties. Fusion molded one piece universal design for multiple P-trap configurations. Adhesives, sewing threads, and two ply laminated materials shall not be allowed. Exterior surfaces shall be smooth nonabsorbent with no finger recessed indentations for easy cleaning. Supply riser shall be flexible and a minimum of 15 inches in length.
 - 2. Provide with weep hole for condensation drainage and ventilation.
 - 3. Fasteners: Reusable, fusion bonded Velcro and tamper resistant snap-locking fasteners with no sharp or abrasive external surfaces. No cable tie fasteners allowed.
- D. Under-Lavatory Covers with Snap-Lock Fasteners:
 - 1. Manufacturers:
 - a. Plumberex Specialty Products, Inc: Plumberex Pro-Extreme; www.plumberex.com/#sle.
 - 2. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.

3. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.
4. Maintenance: Valve and supply cover shall be accessible for maintenance without removal and with removable, reusable access cap.
5. Provide with weep hole for condensation drainage and ventilation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install under-lavatory guards according to manufacturer's written instructions..

3.2 CLEANING

- A. Clean installed under-lavatory guards.

3.3 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 22 0719.11

SECTION 22 1113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
- B. Comply with standards of authorities having jurisdiction for fire-suppression water- service piping, including materials, hose threads, installation, and testing.
- C. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire- service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- G. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF- pw" on piping.

2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
 1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without Construction Manager's and Owner's written permission.

1.5 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.
 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.
 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- C. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.

- E. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
 - 1. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - 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) Anvil International, Inc.
 - 2) Victaulic Company of America.

2.2 JOINING MATERIALS

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.4 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
 - 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. East Jordan Iron Works, Inc.
 - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - g. McWane, Inc.; Kennedy Valve Div.
 - h. McWane, Inc.; M & H Valve Company Div.
 - i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
 - j. Mueller Co.; Water Products Div.
 - k. NIBCO INC.
 - l. U.S. Pipe and Foundry Company.
4. Nonrising-Stem, Metal-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
 - 1) Standard: AWWA C500.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
5. Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.

- 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
- 6. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
 - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig.
 - 3) End Connections: Push on or mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
- 7. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
 - a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
 - 1) Standard: AWWA C500.
 - b. Minimum Pressure Rating: 200 psig.
 - 1) End Connections: Flanged.
- 8. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Flanged.
- B. UL/FMG, Cast-Iron Gate Valves:
 - 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- a. American Cast Iron Pipe Co.; American Flow Control Div.
 - b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - e. McWane, Inc.; Kennedy Valve Div.
 - f. McWane, Inc.; M & H Valve Company Div.
 - g. Mueller Co.; Water Products Div.
 - h. NIBCO INC.
 - i. U.S. Pipe and Foundry Company.
4. UL/FMG, Nonrising-Stem Gate Valves:
- a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.
5. OS&Y, Rising-Stem Gate Valves:
- a. Description: Iron body and bonnet and bronze seating material.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.
- C. Bronze Gate Valves:
- 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Red-White Valve Corporation.
4. OS&Y, Rising-Stem Gate Valves:
- a. Description: Bronze body and bonnet and bronze stem.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Threaded.
5. Nonrising-Stem Gate Valves:
- a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
 - 1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - b. East Jordan Iron Works, Inc.
 - c. Flowserve.

- d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - e. McWane, Inc.; Kennedy Valve Div.
 - f. McWane, Inc.; M & H Valve Company Div.
 - g. Mueller Co.; Water Products Div.
 - h. U.S. Pipe and Foundry Company.
4. Description: Sleeve and valve compatible with drilling machine.
- a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
- 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amcast Industrial Corporation; Lee Brass Co.
 - b. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - c. Jones, James Company.
 - d. Master Meter, Inc.

- e. McDonald, A. Y. Mfg. Co.
 - f. Mueller Co.; Water Products Div.
 - g. Red Hed Manufacturing & Supply.
- B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
- 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
 - 3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
- C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
- D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
- 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 WATER METERS

- A. Water meters will be furnished by utility company.
- B. Manufacturers:
- 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. AMCO Water Metering Systems.
 - b. Badger Meter, Inc.
 - c. Carlon Meter.

- d. Hays Fluid Controls; a division of ROMAC Industries Inc.
- e. McCrometer.
- f. Mueller Co.; Hersey Meters.
- g. Neptune Technology Group Inc.
- h. Sensus Metering Systems.

C. Displacement-Type Water Meters:

- 1. Description: With bronze main case.
 - a. Standard: AWWA C700.
 - b. Registration: Flow in cubic meters.

D. Compound-Type Water Meters:

- 1. Description:
 - a. Standard: AWWA C702.
 - b. Registration: Flow in cubic meters.

2.8 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Regulator Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

4. Standard: ASSE 1013 or AWWA C511.
 5. Operation: Continuous-pressure applications.
 6. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 7. Size: as per drawings.
 8. Design Flow Rate: as per drawings.
 9. Selected Unit Flow Range Limits: as per drawings
 10. Pressure Loss at Design Flow Rate: as per drawings for NPS 2 and smaller; as per drawings for NPS 2-1/2 and larger.
 11. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 12. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 13. Configuration: Designed for horizontal, straight through flow.
 14. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
- B. Double-Check, Backflow-Prevention Assemblies:
1. 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Regulator Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.
 3. Standard: ASSE 1015 or AWWA C510.

4. Operation: Continuous-pressure applications, unless otherwise indicated.
5. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
6. Size: as per drawings
7. Design Flow Rate: as per drawings
8. Selected Unit Flow Range Limits: as per drawings
9. Pressure Loss at Design Flow Rate: as per drawings for NPS 2 and smaller; as per drawings for NPS 2-1/2 and larger.
10. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
11. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
12. Configuration: Designed for horizontal, straight through flow.
13. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 and NPS 6 shall be any of the following:
 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
- G. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- H. Aboveground and vault water-service piping NPS 4 and NPS 6 shall be any of the following:
 1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
- I. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 8 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- J. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 10 shall be any of the following:
 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- K. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 10 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, high-pressure, resilient-seated gate valves with valve box.
 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
- D. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
 - 1. Make connections NPS 2 and smaller with drilling machine according to the following:
 - 2. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - 3. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - 4. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - 5. Install corporation valves into service-saddle assemblies.
 - 6. Install manifold for multiple taps in water main.
 - 7. Install curb valve in water-service piping with head pointing up and with service box.
- E. Comply with NFPA 24 for fire-service-main piping materials and installation.
 - 1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- G. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- I. Bury piping with depth of cover over top at least 30 inches.

- J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- K. Sleeves are specified in Division 22 Section "Common Work Results for Plumbing."
- L. Mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- M. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

- A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved- end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
 - 4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 - 5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - 6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.

3. Set-screw mechanical retainer glands.
 4. Bolted flanged joints.
 5. Heat-fused joints.
 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 3. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. MSS Valves: Install as component of connected piping system.
- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written instructions.
- B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.
- C. Water Meters: Install compound-type water meters, NPS 3 and larger. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.11 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install protective pipe bollards on three sides of each fire department connection. Pipe bollards are specified in Division 05 Section "Metal Fabrications."

3.12 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.
- C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve or service clamp and corporation valve as required on drawings.
- D. Connect water-distribution piping to interior domestic water piping.
- E. Connect waste piping from concrete vault drains to sanitary sewerage system. See Division 22 Section "Facility Sanitary Sewers" for connection to sanitary-sewer piping.

3.13 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.14 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

3.15 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

END OF SECTION 221113 22 1113

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.
6. Escutcheons.
7. Sleeves and sleeve seals.

1.2 RELATED SECTION:

- A. Division 221113 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - 6. Copper Push-on-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NVent LLC.
 - b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O- ring seal in each end.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Gaskets: AWWA C111, rubber.
 2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
 - a. Gaskets: AWWA C111, rubber.

2.4 CPVC PIPING

- A. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.5 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 1. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

2.6 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; 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. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general- duty brazing unless otherwise indicated.
- E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
 - 1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.7 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
- C. CPVC Union Ball Valves:
 - 1. Description:
 - a. Standard: MSS SP-122.
 - b. Pressure Rating: 150 psig at 73 deg F.
 - c. Body Material: CPVC.
 - d. Body Design: Union type.
 - e. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
 - f. End Connections for Valves NPS 2-1/2 to NPS 4 Flanged.
 - g. Ball: CPVC; full port.
 - h. Seals: PTFE or EPDM-rubber O-rings.
 - i. Handle: Tee shaped.
- D. PVC Union Ball Valves:
 - 1. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating: 150 psig at 73 deg F.
- c. Body Material: PVC.
- d. Body Design: Union type.
- e. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
- f. End Connections for Valves NPS 2-1/2 to NPS 4 Flanged.
- g. Ball: PVC; full port.
- h. Seals: PTFE or EPDM-rubber O-rings.
- i. Handle: Tee shaped.

E. PVC Butterfly Valves:

- 1. Description:
 - a. Pressure Rating: 150 psig at 73 deg F.
 - b. Body Material: PVC.
 - c. Body Design: Lug or wafer type.
 - d. Seat: EPDM rubber.
 - e. Seals: PTFE or EPDM-rubber O-rings.
 - f. Disc: PVC.
 - g. Stem: Stainless steel.
 - h. Handle: Lever.

F. CPVC Ball Check Valves:

- 1. Description:
 - a. Pressure Rating: 150 psig at 73 deg F.
 - b. Body Material: CPVC.
 - c. Body Design: Union-type ball check.
 - d. End Connections for Valves NPS 2 and Smaller: Detachable, socket.

- e. End Connections for Valves NPS 2-1/2 to NPS 4 Flanged.
- f. Ball: CPVC.
- g. Seals: EPDM- or FKM-rubber O-rings.

G. CPVC Gate Valves:

- 1. Description:
 - a. Pressure Rating: 150 psig at 73 deg F.
 - b. Body Material: CPVC.
 - c. Body Design: Nonrising stem.
 - d. End Connections for Valves NPS 2 and Smaller: Socket.
 - e. End Connections for Valves NPS 2-1/2 to NPS 4 Flanged.
 - f. Gate and Stem: Plastic.
 - g. Seals: EPDM rubber.
 - h. Handle: Wheel.

2.8 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
 - 1. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.9 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:

1. Description:
 - a. Pressure Rating: 250 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 175 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.

- c. End Connections: Male threaded or grooved.
- d. Lining: Inert and noncorrosive, propylene.

2.10 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 250 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 250 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.11 WATER METERS

- A. Displacement-Type Water Meters:
 - 1. Description:
 - a. Standard: AWWA C700.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: Nutating disc; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility.
 - e. Case: Bronze.
 - f. End Connections: Threaded.
- B. Compound-Type Water Meters:
 - 1. Description:
 - a. Standard: AWWA C702.
 - b. Pressure Rating: 150-psig working pressure.

- c. Body Design: With integral mainline and bypass meters; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility company.
 - e. Case: Bronze.
 - f. Pipe Connections: Flanged.
- C. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

2.12 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated or rough-brass finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.
- E. Split Casting, Cast Brass: Polished, chrome-plated or rough-brass finish with concealed hinge and setscrew.
- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.13 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- E. 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 setscrews.

2.14 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.15 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. PVC/CPVC/ABS PIPING SHALL NOT BE INSTALLED IN ENVIRONMENTAL AIR PLENUMS UNLESS IT HAS A 25/50 FLAME/SMOKE RATING OR IS INSULATED AND THE INSULATION HAS A 25/50 FLAME/SMOKE RATING.
- 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 in Division 22 Section

"Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level with 0.25 percent slope downward toward drain 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 in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- 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 adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- U. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- V. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: 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: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: 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. 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.
- 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. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have

supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. 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.

3.6 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 unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation, and install water meters according to utility company's requirements.
- B. Water meters will be furnished and installed by utility company.
- C. Install water meters according to AWWA M6, utility company's requirements, and the following:
- D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
- E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
- F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 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. 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.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 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 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. 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.
- J. 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.
- K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.
- L. Install hangers for vertical PEX piping every 48 inches.
- M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.

2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6: 48 inches with 3/4-inch rod.
- N. Install supports for vertical PVC piping every 48 inches.
- O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow 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 required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 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.

3.11 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.

3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish cast brass with rough-brass finish.
 5. Bare Piping in Equipment Rooms: One piece, cast brass.
 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
 6. Bare Piping in Equipment Rooms: Split casting, cast brass.
 7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.12 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.13 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 3. 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.
 4. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.16 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.17 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. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be one of the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6, shall be one of the following:
 - 1. Push-on-joint, ductile-iron pipe; standard- or compact- pattern push-on-joint fittings; and gasketed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, 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 or ASTM B 88, Type M; copper pressure-seal- joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper push-on-joint fittings; and push-on joints.
 - 4. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.
- 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 ASTM B 88, solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, pressure-seal- joint fittings; and pressure-sealed joints.
- H. Aboveground domestic water piping, NPS 5 and NPS 6, 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.

3.18 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: Memory-stop balancing valves.
 - a. 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.
- D. CPVC and PVC valves matching piping materials may be used.

END OF SECTION 221116 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.
- D. See Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - i. Standard: ASSE 1001.
 - j. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - k. Body: Bronze.
 - l. Inlet and Outlet Connections: Threaded.
 - m. Finish: Rough bronze.
3. Hose-Connection Vacuum Breakers:

- 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) Arrowhead Brass Products, Inc.
 - 2) Cash Acme.
 - 3) Conbraco Industries, Inc.
 - 4) Legend Valve.
 - 5) MIFAB, Inc.
 - 6) Prier Products, Inc.
 - 7) Watts Industries, Inc.; Water Products Div.
 - 8) Woodford Manufacturing Company.
 - 9) Zurn Plumbing Products Group; Light Commercial Operation.
 - 10) Zurn Plumbing Products Group; Wilkins Div.
- c. Standard: ASSE 1001.
- d. Body: Bronze, nonremovable, with manual drain.
- e. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- f. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.

- d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
- 3. Standard: ASSE 1012.
- 4. Operation: Continuous-pressure applications.
- 5. Size: NPS 3/4.
- 6. Body: Bronze.
- 7. End Connections: Solder joint.
- 8. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:
 - 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 4. Standard: ASSE 1013.
 - 5. Operation: Continuous-pressure applications.
 - 6. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 - 7. Size: as per drawings

8. Design Flow Rate: as per drawings
 9. Selected Unit Flow Range Limits: as per drawings
 10. Pressure Loss at Design Flow Rate: as per drawings for sizes NPS 2 and smaller; as per drawings for NPS 2-1/2 and larger.
 11. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 12. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 13. Configuration: Designed for horizontal, straight through flow.
 14. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2- 1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check Backflow-Prevention Assemblies:
1. 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 4. Standard: ASSE 1015.
 5. Operation: Continuous-pressure applications, unless otherwise indicated.
 6. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

7. Size: as per drawings
8. Design Flow Rate: as per drawings
9. Selected Unit Flow Range Limits: as per drawings
10. Pressure Loss at Design Flow Rate: as per drawings for sizes NPS 2 and smaller; as per drawings for NPS 2-1/2 and larger.
11. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
12. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
13. Configuration: Designed for horizontal, straight through flow.
14. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2- 1/2 and larger.

D. Backflow-Preventer Test Kits:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Flomatic Corporation.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
4. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test- procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1003.
4. Pressure Rating: Initial working pressure of 150 psig.
5. Size: as per drawings
6. Design Flow Rate: as per drawings
7. Design Inlet Pressure: as per drawings
8. Design Outlet Pressure Setting: as per drawings
9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
10. Valves for Booster Heater Water Supply: Include integral bypass.
11. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.

- d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corp.
- 3. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 - 4. Pressure Rating: 400-psig minimum CWP.
 - 5. Size: NPS 2 or smaller.
 - 6. Body: Copper alloy.
 - 7. Port: Standard or full port.
 - 8. Ball: Chrome-plated brass.
 - 9. Seats and Seals: Replaceable.
 - 10. End Connections: Solder joint or threaded.
 - 11. Handle: Vinyl-covered steel with memory-setting device.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 - e. Legend Valve.

- f. Leonard Valve Company.
 - g. Powers; a Watts Industries Co.
 - h. Symmons Industries, Inc.
 - i. Taco, Inc.
 - j. Watts Industries, Inc.; Water Products Div.
 - k. Zurn Plumbing Products Group; Wilkins Div.
- 4. Standard: ASSE 1017.
- 5. Pressure Rating: 125 psig.
- 6. Type: Thermostatically controlled water mixing valve.
- 7. Material: Bronze body with corrosion-resistant interior components.
- 8. Connections: Threaded union inlets and outlet.
- 9. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature- control handle.
- 10. Tempered-Water Setting: 105°F
- 11. Tempered-Water Design Flow Rate: as per drawings
- 12. Valve Finish: Rough bronze.
- B. Primary, Thermostatic, Water Mixing Valves:
 - 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.

- e. Symmons Industries, Inc.
- 4. Standard: ASSE 1017.
- 5. Pressure Rating: 125 psig.
- 6. Type: Exposed-mounting, thermostatically controlled water mixing valve.
- 7. Material: Bronze body with corrosion-resistant interior components.
- 8. Connections: Threaded union inlets and outlet.
- 9. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
- 10. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
- 11. Tempered-Water Setting: 105 °F
- 12. Tempered-Water Design Flow Rate: as per drawings
- 13. Selected Valve Flow Rate at 45-psig Pressure Drop: as per drawings
- 14. Pressure Drop at Design Flow Rate: as per drawings
- 15. Valve Finish: Rough bronze.
- 16. Piping Finish: Copper.
- 17. Cabinet: Factory-fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

2.6 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 complying with AWWA C550 or FDA-approved, epoxy coating 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: 0.020 inch.

- b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
- c. Strainers NPS 5 and Larger: 0.10 inch.
- 6. Drain: Factory-installed, hose-end drain valve.

2.7 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, hose drainable, 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: Operating key.	
13.	Operation for Finished Rooms: Operating key.	
14.	Include operating key with each operating-key hose bibb.	
15.	Include integral wall flange with each chrome- or nickel-plated hose bibb.	

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.

- f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 3. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 - 4. Pressure Rating: 125 psig.
 - 5. Operation: Loose key.
 - 6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 7. Inlet: NPS 3/4 or NPS 1.
 - 8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 9. Box: Deep, flush mounting with cover.
 - 10. Box and Cover Finish: Polished nickel bronze.
 - 11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 12. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 - 13. Operating Keys(s): Two with each wall hydrant.
- B. Vacuum Breaker Wall Hydrants:
- 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Mansfield Plumbing Products LLC.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Prier Products, Inc.
 - e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.

- f. Watts Industries, Inc.; Water Products Div.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
- 3. Standard: ASSE 1019, Type A or Type B.
 - 4. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
 - 5. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
 - 6. Pressure Rating: 125 psig.
 - 7. Operation: Loose key.
 - 8. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 9. Inlet: NPS 1/2 or NPS 3/4.
 - 10. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.9 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.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: Metal bellows.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
3. Standard: ASSE 1018.

4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing 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 thermometers and water regulators if specified.
 2. 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 water hammer arresters in water piping according to PDI-WH 201.

- H. 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.
- I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Water pressure-reducing valves.
 - 5. Primary, thermostatic, water mixing valves.
 - 6. Supply-type, trap-seal primer valves.
- K. 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check backflow- prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.

SET FIELD-ADJUSTABLE TEMPERATURE SET POINTS OF TEMPERATURE-ACTUATED WATER MIXING VALVES. END OF SECTION 221119 22 1119

SECTION 22 1122 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Service meters.
 - 7. Concrete bases.

1.3 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.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 150 psig (1035 kPa) minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig (690 kPa) minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: [5 psig (34.5 kPa)] [10 psig (69 kPa)] [20 psig (138 kPa)] [65 psig (450 kPa)].

- B. Natural-Gas System Pressure within Buildings: [0.5 psig (3.45 kPa) or less] [More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa)] [More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa)].
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Service meters. Indicate[pressure ratings and] capacities. Include [bypass fittings] [bypass fittings and meter bars] [meter bars] [supports].
 - 6. Dielectric fittings.
- B. Delegated-Design Submittal: For natural-gas piping and equipment 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 seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For [motorized gas valves] [pressure regulators] [and] [service meters] to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Steel Support 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.
- C. 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. 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.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify the Owner no fewer than seven days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without the Owner's written permission.

1.11 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 1) Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - (a) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 - 2) Mechanical Couplings:
 - (a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (1) Dresser Piping Specialties; Division of Dresser, Inc.
 - (2) Smith-Blair, Inc.
 - (b) [Stainless-steel] [Steel] flanges and tube with epoxy finish.
 - (c) Buna-nitrile seals.
 - (d) [Stainless-steel] [Steel] bolts, washers, and nuts.

- (e) Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - (f) Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
 - f. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (a) Parker Hannifin Corporation; Parflex Division.
 - (b) Titeflex.
 - (c) Gastite.
 - 2) Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 3) Coating: PE with flame retardant.
 - (a) Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - (1) Flame-Spread Index: 25 or less.
 - (2) Smoke-Developed Index: [50] [450] or less.
 - 4) Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - 5) Striker Plates: Steel, designed to protect tubing from penetrations.
 - 6) Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 - 7) Operating-Pressure Rating: 5 psig (34.5 kPa).
- B. PE Pipe: ASTM D 2513, SDR 11.
 - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.[Vent casing aboveground.]
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
5. Plastic Mechanical Couplings,NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Lyall, R. W. & Company, Inc.
 - 2) Mueller Co.; Gas Products Div.
 - 3) Perfection Corporation; a subsidiary of American Meter Company.
 - b. PE body with molded-in, stainless-steel support ring.

- c. Buna-nitrile seals.
 - d. Acetal collets.
 - e. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Lyall, R. W. & Company, Inc.
 - 2) Mueller Co.; Gas Products Div.
 - 3) Perfection Corporation; a subsidiary of American Meter Company.
 - b. Fiber-reinforced plastic body.
 - c. PE body tube.
 - d. Buna-nitrile seals.
 - e. Acetal collets.
 - f. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. [Stainless-steel] [Steel] flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. [Stainless-steel] [Steel] bolts, washers, and nuts.
 - e. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 4. Corrugated stainless-steel tubing with polymer coating.
 5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
 6. End Fittings: Zinc-coated steel.
 7. Threaded Ends: Comply with ASME B1.20.1.
 8. Maximum Length: 72 inches (1830 mm.)
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
 2. Nitrile seals.
 3. Hand operated with automatic shutoff when disconnected.
 4. For indoor or outdoor applications.
 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig (862 kPa).
- D. Basket Strainers:
1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

4. CWP Rating: 125 psig (862 kPa).

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig (5170 kPa).

- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
1. CWP Rating: 150 psig (1035 kPa).
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.

6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
 1. CWP Rating: 150 psig (1035 kPa).
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig (4140 kPa).
 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- E. Three-Piece, Full-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig (4140 kPa).
 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 - d. Conbraco Industries, Inc.; Apollo Div.
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.

4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig (862 kPa).
 7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonald, A. Y. Mfg. Co.
 - b. Mueller Co.; Gas Products Div.
 - c. Xomox Corporation; a Crane company.
 2. Body: Cast iron, complying with ASTM A 126, Class B.
 3. Plug: Bronze or nickel-plated cast iron.
 4. Seat: Coated with thermoplastic.
 5. Stem Seal: Compatible with natural gas.
 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. Operator: Square head or lug type with tamperproof feature where indicated.
 8. Pressure Class: 125 psig (862 kPa).
 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.

- c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
- 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.
 - 4. Seat: Coated with thermoplastic.
 - 5. Stem Seal: Compatible with natural gas.
 - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. Operator: Square head or lug type with tamperproof feature where indicated.
 - 8. Pressure Class: 125 psig (862 kPa).
 - 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- I. PE Ball Valves: Comply with ASME B16.40.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 - 2. Body: PE.
 - 3. Ball: PE.
 - 4. Stem: Acetal.
 - 5. Seats and Seals: Nitrile.
 - 6. Ends: Plain or fusible to match piping.
 - 7. CWP Rating: 80 psig (552 kPa).

8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

J. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eaton Corporation; Controls Div.
 - d. Eclipse Combustion, Inc.
 - e. Honeywell International Inc.
 - f. Johnson Controls.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. [Electrical] [Mechanical] operator for actuation by appliance automatic shutoff device.

- B. Electrically Operated Valves: Comply with UL 429.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eclipse Combustion, Inc.
 - d. Goyen Valve Corp.; Tyco Environmental Systems.
 - e. Magnatrol Valve Corporation.
 - f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
 - g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 2. Pilot operated.
 3. Body: Brass or aluminum.
 4. Seats and Disc: Nitrile rubber.
 5. Springs and Valve Trim: Stainless steel.
 6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
 7. NEMA ICS 6, Type 4, coil enclosure.
 8. Normally closed.
 9. Visual position indicator.

2.6 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Vanguard Valves, Inc.
 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 3. Maximum Operating Pressure: 5 psig (34.5 kPa).
 4. Cast-aluminum body with nickel-plated chrome steel internal parts.
 5. Nitrile-rubber valve washer.

6. Sight windows for visual indication of valve position.
 7. Threaded end connections complying with ASME B1.20.1.
 8. Wall mounting bracket with bubble level indicator.
- B. Earthquake Valves: Comply with ASCE 25.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 2. Pacific Seismic Products, Inc.
 3. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 4. Maximum Operating Pressure: [0.5 psig (3.45 kPa)] [7 psig (48 kPa)] [60 psig (414 kPa)].
 5. Cast-aluminum body with stainless-steel internal parts.
 6. Nitrile-rubber, reset-stem o-ring seal.
 7. Valve position, open or closed, indicator.
 8. Composition valve seat with clapper held by spring or magnet locking mechanism.
 9. Level indicator.
 10. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.

2.7 PRESSURE REGULATORS

- A. General Requirements:
1. Single stage and suitable for natural gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.

- c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - d. Invensys.
 - e. Richards Industries; Jordan Valve Div.
 - 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 6. Orifice: Aluminum; interchangeable.
 - 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - 12. Maximum Inlet Pressure: 100 psig (690 kPa).
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: [2 psig (13.8 kPa)] [5 psig (34.5 kPa)] [10 psig (69 kPa)].
- D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
 2. Body and Diaphragm Case: Die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: [1 psig (6.9 kPa)] [2 psig (13.8 kPa)] [5 psig (34.5 kPa)].

2.8 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with [ANSI B109.1] [ANSI B109.2].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Invensys.
2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature[and pressure].
7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig (690 kPa).
11. Pressure Loss: Maximum [0.5-inch wg (124 Pa)] [2.0-inch wg (498 Pa)].
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Invensys.
2. Case: Extruded aluminum.

3. Connection: Flange.
 4. Impellers: Polished aluminum.
 5. Rotor Bearings: Self-lubricating.
 6. Compensation: Continuous temperature[and pressure].
 7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].
 8. Tamper resistant.
 9. Remote meter reader compatible.
 10. Maximum Inlet Pressure: 100 psig (690 kPa).
 11. Accuracy: Maximum plus or minus 2.0 percent.
- C. Turbine Meters: Comply with ASME MFC-4M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Invensys.
 2. Housing: Cast iron or welded steel.
 3. Connection Threads or Flanges: Steel.
 4. Turbine: Aluminum or plastic.
 5. Turbine Bearings: Self-lubricating.
 6. Compensation: Continuous temperature[and pressure].
 7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].
 8. Tamper resistant.
 9. Remote meter reader compatible.
 10. Maximum Inlet Pressure: 100 psig (690 kPa).
 11. Accuracy: Maximum plus or minus 2.0 percent.
- D. Service-Meter Bars:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Actaris.
 - b. American Meter Company.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Mueller Co.; Gas Products Div.
 - f. Perfection Corporation; a subsidiary of American Meter Company.
2. Malleable- or cast-iron frame for supporting service meter.
 3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
 4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
- E. Service-Meter Bypass Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lyall, R. W. & Company, Inc.
 - b. Williamson, T. D., Inc.
 2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
 3. Integral ball-check bypass valve.

2.9 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.

- f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [250 psig (1725 kPa)].
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Matco-Norca, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. 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)].
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.

- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.
- 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to [NFPA 54] [the International Fuel Gas Code] to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with [NFPA 54] [the International Fuel Gas Code] requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with [NFPA 54] for installation and purging of natural-gas piping.

- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

- A. Comply with [NFPA 54] for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.

- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

- A. Install service-meter assemblies aboveground[, on concrete bases].
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.

- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.9 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.

- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 PAINTING

- A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel [(flat)] [(semigloss)] [(gloss)].
 - d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: [Alkyd anticorrosive] [Quick-drying alkyd] metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex [(flat)] [(low sheen)] [(eggshell)] [(satin)] [(semigloss)] [(gloss)].
 - d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].

2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: [Alkyd anticorrosive] [Quick-drying alkyd] metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd [(flat)] [(eggshell)] [(semigloss)] [(gloss)].
 - d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base[according to seismic codes at Project].
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) 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 (450-mm) 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. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Test, inspect, and purge natural gas according to [NFPA 54] [the International Fuel Gas Code] and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.14 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Wrap and coat pipe and fittings with protective coating for steel piping.
 - 3. [Annealed] [Drawn]-temper copper tube with wrought-copper fittings and brazed joints. Coat and sleeve pipe and fittings with protective coating for copper tubing.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints. Paint with corrosion prevention paint.
 - 2. Steel pipe with wrought-steel fittings and welded joints. Paint with corrosion prevention paint.
 - 3. [Annealed] [Drawn]-temper copper tube with wrought-copper fittings and brazed or flared joints. Provide damage prevention fencing around piping.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and [brazed] [flared] joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 KPA)

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller limited to specialty equipment shall be one of the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - 2. Annealed-temper, copper tube with wrought-copper fittings and [brazed] [flared] joints.
 - 3. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 - C. Underground, below building, piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 - D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 - E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 KPA) AND LESS THAN 5 PSIG (34.5 KPA)
- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 2. Annealed-temper, copper tube with wrought-copper fittings and [brazed] [flared] joints.
 3. Steel pipe with malleable-iron fittings and threaded joints.
 - B. Aboveground, distribution piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with steel welding fittings and welded joints.
 - C. Underground, below building, piping shall be one of the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 - D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
 - E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.18 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG (34.5 KPA)
- A. Aboveground Piping: Maximum operating pressure more than 5 psig (34.5 kPa).

- B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
- C. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with steel welding fittings and welded joints.
 - 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- D. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.19 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 - 1. PE valves.
 - 2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
 - 3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, [lubricated] [nonlubricated] plug valves.

3.20 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.

3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
 3. Cast-iron, [nonlubricated] [lubricated] plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.

END OF SECTION 231123 22 1122

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
- B. See Division 22 Section "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.2 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.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
 - 2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

- b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. 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.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought- copper, solder-joint fittings.
- E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. PVC/CPVC/ABS PIPING SHALL NOT BE INSTALLED IN ENVIRONMENTAL AIR PLENUMS UNLESS IT HAS A 25/50 FLAME/SMOKE RATING OR IS INSULATED AND THE INSULATION HAS A 25/50 FLAME/SMOKE RATING.
- D. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 5. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 6. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 5. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 6. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- G. Underground, 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 compression joints.
 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
 4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees.

Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Use gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage 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. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch 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: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. 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: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

- 5. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and 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: 48 inches with 3/4-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. Grease interceptors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.

- c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 4. Standard: ASME A112.14.1.
 - 5. Size: Same as connected piping.
 - 6. Body: Cast iron.
 - 7. Cover: Cast iron with bolted or threaded access check valve.
 - 8. End Connections: Hub and spigot.
 - 9. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
 - 10. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field- installed cleanout at floor; replaces backwater valve cover.
- B. Drain-Outlet Backwater Valves:
- 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 3. Size: Same as floor drain outlet.
 - 4. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
 - 5. Check Valve: Removable ball float.
 - 6. Inlet: Threaded.
 - 7. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
5. Size: Same as connected drainage piping
6. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
7. Closure: Countersunk or raised-head, brass plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.

- c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
- 4. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 - 5. Size: Same as connected branch.
 - 6. Type: Threaded, adjustable housing.
 - 7. Body or Ferrule: Cast iron.
 - 8. Clamping Device: Required.
 - 9. Outlet Connection: Spigot.
 - 10. Closure: Brass plug with straight threads and gasket.
 - 11. Adjustable Housing Material: Cast iron with threads.
 - 12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 13. Frame and Cover Shape: Round or Square as per drawings.
 - 14. Top Loading Classification: Extra Heavy Duty.
 - 15. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
- 1. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.

- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 4. Standard: ASME A112.36.2M. Include wall access.
 - 5. Size: Same as connected drainage piping.
 - 6. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
 - 7. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
 - 8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 9. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 - 10. Wall Access: Round or Square as per drawings, nickel-bronze, copper-alloy, or stainless- steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.

- h. Zurn Plumbing Products Group; Light Commercial Operation.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 4. Standard: ASME A112.6.3 with backwater valve.
- 5. Pattern: Area drain.
- 6. Body Material: Gray iron.
- 7. Seepage Flange: Not required.
- 8. Anchor Flange: Required.
- 9. Clamping Device: Required.
- 10. Outlet: Bottom or side.
- 11. Backwater Valve: Integral, ASME A112.14.1, swing-check type.
- 12. Coating on Interior and Exposed Exterior Surfaces: Not required.
- 13. Sediment Bucket: Insert description.
- 14. Top or Strainer Material: Bronze.
- 15. Top of Body and Strainer Finish: Rough bronze.
- 16. Top Shape: Round or Square as per drawings.
- 17. Top Loading Classification: Extra Heavy-Duty.
- 18. Funnel: Not required.
- 19. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
- 20. Trap Material: Bronze.
- 21. Trap Pattern: Standard P-trap.
- 22. Trap Features: Cleanout and trap-seal primer valve drain connection.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

- 1. 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:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 1. Open-Top Vent Cap: Without cap.
 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.7 GREASE INTERCEPTORS

A. Grease Interceptors:

- 1. 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:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Applied Chemical Technology, Incorporated.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Rockford Sanitary Systems, Inc.
 - e. Schier Products Company.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Specification Drainage Operation.
 - k. Ashland Trap Distribution Co.
 - l. Bio-Microbics, Inc.
 - m. Canplas LLC.
 - n. Schier Products Company.
 - o. Zurn Plumbing Products Group; Light Commercial Operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1- inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

- 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Assemble open drain fittings and install with top of hub 1 inch above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- N. Install vent caps on each vent pipe passing through roof.
- O. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 - 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

3.6 PLACE PLUGS IN ENDS OF UNCOMPLETED PIPING AT END OF EACH DAY OR WHEN WORK STOPS.

END OF SECTION 221319 22 1319

SECTION 22 1320 - SANITARY WASTE INTERCEPTORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sand/Oil interceptors.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of [metal] [and] [plastic] interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
 - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:
 - 1. Interceptors.
 - 2. Piping connections. Include size, location, and elevation of each.
 - 3. Interface with underground structures and utility services.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify [Architect] [Construction Manager] [Owner] no fewer than [seven] [Insert number] days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without [Architect's] [Construction Manager's] [Owner's] written permission.

PART 2 PRODUCTS

2.1 SAND/OIL INTERCEPTORS

- A. Sand/Oil Interceptors: Precast concrete comply with ASTM C 913.
1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
 2. Structural Design Loads:
 - a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
 - b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
 - c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - d. Walkway Load: Comply with ASTM C 890, A-03.
 3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
 4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
 5. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 - a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 - b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 - c. Include indented top design with lettering cast into cover, using wording equivalent to "SAND / OIL INTERCEPTOR."

2.2 PRECAST-CONCRETE MANHOLE RISERS

- A. Precast-Concrete Manhole Risers: [ASTM C 478 (ASTM C 478M)] [ASTM C 913], with rubber-gasket joints.
1. Structural Design Loads:

- a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
 - b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
 - c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - d. Walkway Load: Comply with ASTM C 890, A-03.
2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch (75-mm) minimum thickness and [36-inch (915-mm)] [Insert dimension] diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
- B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.
- C. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 3. Include indented top design with lettering cast into cover, using wording equivalent to the following:
 - a. Grease Interceptors in Sanitary Sewerage System: "[INTERCEPTOR] [GREASE INTERCEPTOR] [SANITARY SEWER] [Insert lettering]."
 - b. Oil Interceptors in Sanitary Sewerage System: "[INTERCEPTOR] [OIL INTERCEPTOR] [SANITARY SEWER] [Insert lettering]."

PART 3 EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

- A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

- B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
- C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.
- D. Set tops of grating frames and grates flush with finished surface.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 1. Use warning tapes or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 221320 22 1320

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters:
 - 1. Commercial Indirect.
- B. In-line circulator pumps.

1.2 RELATED REQUIREMENTS

- A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data:
 - 1. Indicate pump type, capacity, power requirements.
 - 2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 3. Provide electrical characteristics and connection requirements.
- C. Shop Drawings:
 - 1. Indicate heat exchanger dimensions, size of tappings, and performance data.
 - 2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

1.5 QUALITY ASSURANCE

A. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

B. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
2. Bradford White.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Commercial Indirect:

1. Performance: See Drawings
2. Tank: Glass lined welded steel; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
3. Accessories:
 - a. Water Connections: Brass.

- b. Dip Tube: Brass.
- c. Drain valve.
- d. Anode: Magnesium.
- 4. Certified For The Following Applications:
 - a. Automatic storage water heater.

2.2 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 - 1. Grundfos
 - 2. Taco : www.taco-hvac.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Performance: See Drawings for Model information / required accesories

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
 - 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 22 3000

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 23 0553 - Identification for HVAC Piping and Equipment: Piping identification.
- C. Section 23 0716 - HVAC Equipment Insulation.
- D. Section 23 0719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.6 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Manufacturers:

1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

E. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.

3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 1. Aboveground Piping:
 - a. Pack solid using mineral fiber in compliance with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 2. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
- E. Manufactured Sleeve-Seal Systems:
 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.2 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 23 0517

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Freestanding and restrained spring isolators.
 - e. Housed spring mounts.
 - f. Elastomeric hangers.
 - g. Spring hangers.
 - h. Spring hangers with vertical-limit stops.
 - i. Pipe riser resilient supports.
 - j. Resilient pipe guides.
 - k. Freestanding and restrained air-mounting system.
 - l. Restrained vibration isolation roof-curb rails.
 - m. Seismic snubbers.
 - n. Restraining braces and cables.
 - o. Steel and inertia, vibration isolation equipment bases.

C. DEFINITIONS

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. PERFORMANCE REQUIREMENTS

1. Wind-Restraint Loading:
 - a. Basic Wind Speed: 140mph
 - b. Building Classification Category: IV.
 - c. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
2. Seismic-Restraint Loading:
 - a. See Drawings

E. ACTION SUBMITTALS

1. Product Data: For the following:
 - a. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - b. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - c. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
 - 1) Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
 - c. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails,

base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

d. Seismic and Wind Restraint Details:

- 1) Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
- 2) Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
- 3) Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

F. INFORMATIONAL SUBMITTALS

1. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
2. Qualification Data: For professional engineer
3. Welding certificates.
4. Field quality-control test reports.

G. CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

H. QUALITY ASSURANCE

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
2. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
3. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

4. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Kinetics Noise Control.
 2. Mason Industries.
 3. Vibro-Acoustics.
 4. Pads Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene
 5. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory- drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
 6. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

7. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
8. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
9. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - a. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - b. Base: Factory drilled for bolting to structure.

- c. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
- 10. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- 11. Spring Hangers: Combination coil-spring and elastomeric- insert hanger with spring and insert in compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- 12. Spring Hangers with Vertical-Limit Stop: Combination coil- spring and elastomeric-insert hanger with spring and insert in compression and with a vertical- limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

- g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
13. Pipe Riser Resilient Support : All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
14. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. AIR-MOUNTING SYSTEMS

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. California Dynamics Corporation.
 - b. Firestone Industrial Products Company.
 - c. Kinetics Noise Control.
 - d. Mason Industries.
 - e. Vibration Eliminator Co., Inc.
- 2. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
 - a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows.
 - b. Maximum Natural Frequency: 3 Hz.
 - c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
 - d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
 - e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).
- 3. Restrained Air Mounts : Housed compressed-air bellows.

- a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
- b. Maximum Natural Frequency: 3 Hz.
- c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
- d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
- e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).

C. RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amber/Booth Company, Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control.
 - e. Mason Industries.
 - f. Thybar Corporation.
 - g. Vibration Eliminator Co., Inc.
 - h. Vibration Isolation.
 - i. Vibration Mountings & Controls, Inc.
- 2. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- 3. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

4. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- (6-mm-) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - a. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or wind restraint.
 - 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - 2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3) Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1) Resilient Material: Oil- and water-resistant standard neoprene
5. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
6. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

D. VIBRATION ISOLATION EQUIPMENT BASES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amber/Booth Company, Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control.
 - e. Mason Industries.

- f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation.
 - h. Vibration Mountings & Controls, Inc.
- 2. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25- mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- 3. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25- mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - d. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

E. SEISMIC-RESTRAINT DEVICES

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amber/Booth Company, Inc.
 - b. California Dynamics Corporation.

- c. Cooper B-Line, Inc.; a division of Cooper Industries.
 - d. Hilti, Inc.
 - e. Kinetics Noise Control.
 - f. Loos & Co.; Cableware Division.
 - g. Mason Industries.
 - h. TOLCO Incorporated; a brand of NIBCO INC.
 - i. Unistrut; Tyco International, Ltd.
2. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
- a. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - b. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - c. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.
3. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
4. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
5. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
6. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
7. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
8. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

9. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
10. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

F. FACTORY FINISHES

1. Finish: Manufacturer's standard prime-coat finish ready for field painting.
2. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - a. Powder coating on springs and housings.
 - b. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - c. Baked enamel or powder coat for metal components on isolators for interior use.
 - d. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. APPLICATIONS

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

E. VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

1. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
2. Equipment Restraints:
 - a. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - b. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
3. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - c. Brace a change of direction longer than 12 feet (3.7 m).
4. Install cables so they do not bend across edges of adjacent equipment or building structure.
5. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
6. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
7. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
8. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
9. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling.

Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

- b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- e. Set anchors to manufacturer's recommended torque, using a torque wrench.
- f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

F. ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- 1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

G. ADJUSTING

- 1. Adjust isolators after piping system is at operating weight.
- 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- 3. Adjust air-spring leveling mechanism.
- 4. Adjust active height of spring isolators.
- 5. Adjust restraints to permit free movement of equipment within normal mode of operation.

H. DEMONSTRATION

- 1. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 230548 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.
- E. Ceiling Tacks

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Control Panels: Nameplates.
- D. Major Control Components: Nameplates.
- E. Piping: Tags.
- F. Pumps: Nameplates.

- G. Tanks: Nameplates.
- H. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- I. Water Treatment Devices: Nameplates.

2.2 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.3 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.4 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.6 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.

2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify thermostats relating to terminal boxes or valves with nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.4 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of refrigerating systems.
- C. Measurement of final operating condition of HVAC systems.

1.2 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

1.3 REFERENCE STANDARDS

- A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- B. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).
- C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to DEDC, LLC.
 - 2. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Detailed step-by-step procedures for TAB work for each system and issue, including:

- 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - f. Expected problems and solutions, etc.
 - g. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - h. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - i. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - j. Procedures for formal deficiency reports, including scope, frequency and distribution.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for DEDC, LLC and for inclusion in operating and maintenance manuals.
 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 6. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.

- c. Telephone number of Testing, Adjusting, and Balancing Agency.
- d. Project name.
- e. Project location.
- f. Project Engineer.
- g. Project Contractor.
- h. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. TAB contractor shall review all of the drawings with special attention to the controls drawings as there is additional instruction on the drawings and sequence of operation as to how balancing shall be performed and what information the controls contractor is required to obtain.
- B. TAB contractor shall perform ductwork leak tests prior to installation of ceiling. TAB contractor shall schedule this work thru the mechanical contractor.
- C. Perform total system balance in accordance with one of the following:
 - 1. SMACNA (TAB).
- D. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- E. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- F. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by one of the following:
 - a. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management
Institute: www.tabbcertified.org/#sle.
- G. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to DEDC, LLC to facilitate spot checks during testing.

3.4 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

3.7 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Fire Pumps.
 - 2. Plumbing Pumps.
 - 3. VRF Systems

4. Packaged Roof Top Heating/Cooling Units.
5. Make-up Air Units
6. Fans.
7. Air Filters.
8. Air Inlets and Outlets.

3.8 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.

4. Impeller.
 5. Service.
 6. Design flow rate, pressure drop, BHP.
 7. Actual flow rate, pressure drop, BHP.
 8. Discharge pressure.
 9. Suction pressure.
 10. Total operating head pressure.
- D. Air Cooled Condensers:
1. Identification/number.
 2. Location.
 3. Manufacturer.
 4. Model number.
 5. Serial number.
 6. Entering DB air temperature, design and actual.
 7. Leaving DB air temperature, design and actual.
 8. Number of compressors.
- E. Cooling Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Entering air DB temperature, design and actual.
 7. Entering air WB temperature, design and actual.
 8. Leaving air DB temperature, design and actual.

9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

F. Heating Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

G. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.

5. Arrangement/Class/Discharge.
 6. Air flow, specified and actual.
 7. Return air flow, specified and actual.
 8. Outside air flow, specified and actual.
 9. Total static pressure (total external), specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Sheave Make/Size/Bore.
 13. Number of Belts/Make/Size.
 14. Fan RPM.
- H. Return Air/Outside Air:
1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
 4. Design return air flow.
 5. Actual return air flow.
 6. Design outside air flow.
 7. Actual outside air flow.
 8. Return air temperature.
 9. Outside air temperature.
 10. Required mixed air temperature.
 11. Actual mixed air temperature.
 12. Design outside/return air ratio.
 13. Actual outside/return air ratio.
- I. Exhaust Fans:

1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.
 10. Number of Belts/Make/Size.
 11. Fan RPM.
- J. Duct Traverses:
1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
 10. Air correction factor.
- K. Duct Leak Tests:
1. Description of ductwork under test.
 2. Duct design operating pressure.

3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
 - a. Blower.
 - b. Orifice, tube size.
 - c. Orifice size.
 - d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.
- L. Terminal Unit Data:
 1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.

END OF SECTION 23 0593

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass Fiber, Flexible.
- B. Glass Fiber, Rigid
- C. Jackets.
- D. Duct insulation.
- E. Insulation jackets.

1.2 RELATED REQUIREMENTS

- A. Section 23 0553 - Identification for HVAC Piping and Equipment.
- B. Section 23 3100 - HVAC Ducts and Casings

1.3 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2016.
- H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2014.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Johns Manville; _____: www.jm.com/#sle.
 - 2. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Minimum Density of 1.0 PCF.

C. Vapor Barrier Jacket:

1. 0.0032 inch vinyl.
2. Moisture Vapor Permeability: 1.3 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. Johns Manville; _____: www.jm.com/#sle.
2. Owens Corning Corp: www.owenscorning.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. 0.0032 inch vinyl.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc; Aerocel Sheet and Roll with PSA: www.aeroflexusa.com/#sle.
2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.5 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

B. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.

1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
2. Thickness: 34 mils.
3. Finish: Smooth.
4. Color: White.
5. Water Vapor Transmission: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
6. Mold Resistance: Pass when tested in accordance with ASTM C1338.

C. PVC Plastic.

1. Manufacturers:
 - a. Johns Manville Corporation; www.jm.com.
 - b. KFlexUSA
 - c. b. Substitutions: See Section 01 6000 - Product Requirements.
2. Jacket: One piece molded type fitting covers and sheet material, white
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.

- c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested
in accordance with ASTM E96/E96M.
- d. Thickness: 12 mil.
- e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 - 1. For rigid polyisocyanurate, installation shall only be completed by manufacturer licensed contractors.
- B. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces _____: Finish with PVC Jacket (see section above).
- E. Exterior Applications: Provide insulation with Aluminum or Flexible Weather Proofing Outdoor jacket. See section above _____.
- F. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.3 SCHEDULES

- A. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation when located inside the building and a minimum of R-8 insulation when located outside the building. When located within a building assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.
 1. Exceptions
 - a. When located within equipment
 - b. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).
- B. All exposed exterior duct to be insulated / jacketed
- C. All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the International Mechanical Code.

END OF SECTION 23 0713

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.
- D. Engineered wall outlet seals and refrigerant piping insulation protection.

1.2 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- J. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

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

- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation; _____: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. Maximum Service Temperature: 650 degrees F.
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.

- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

2.3 EPDM FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

- 1. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
- 2. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
- 3. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

- 1. Minimum Service Temperature: Minus 40 degrees F.
- 2. Maximum Normal Service Temperature: 220 degrees F.
- 3. Maximum "Upset Condition" Service Temperature: 250 degrees F for 10hr duration without degradation.
- 4. Connection: Waterproof vapor barrier adhesive.

2.4 JACKETS

A. PVC Plastic.

1. Manufacturers:

- a. Johns Manville Corporation; None - N/A: www.jm.com/#sle.
- b. K-Flex USA.
- c. Substitutions: See Section 01 6000 - Product Requirements.

2. Jacket: One piece molded type fitting covers and sheet material, white color.

- a. Minimum Service Temperature: 0 degrees F.
- b. Maximum Service Temperature: 150 degrees F.
- c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 10 mil.
- e. Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Manufacturers:

1. Airex Manufacturing, Inc; None - N/A: www.airexmfg.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.

1. Pipe Penetration Wall Seal: Airex Titan Outlet.
2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.

C. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.

1. Outlet Cover Color: Gray.

D. Pipe strut / hanger insulation

1. Hydra-Zorb "Klo-Shure" Series 8, or 9 strut mounts
2. Hydra-Zorb TRH Hanger system
3. Substitutions: See Section 01600 - Product Requirements

E. Insulation Protection System: Refrigerant piping insulation PVC protective cover.

1. PVC Insulation Cover Color: White with full-length velcro fastener.
2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.

5. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.

- I. Pipe Exposed in Finished Spaces or Mechanical Rooms: Finish with insulation and white PVC Jacket (see above)
- J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with PVC (with UV protection) or Aluminum jacket with seams located on bottom side of horizontal piping.

3.3 SCHEDULE

- A. Heating Systems:
 - 1. Heating Water Supply and Return: Glass Fiber or Elastomeric Cellular (thickness as required by IECC)
 - 2. Glycol Heating Supply and Return: Glass Fiber or Elastomeric Cellular (thickness as required by IECC)
- B. VRV/VRF Piping (Confirm the sizing below with IECC requirements for the VRF system provided by the Mechanical Contractor)
 - 1. High Pressure Vapor Line up to <1" diameter: 1.5" thick EPDM Flexible Elastomeric Cellular
 - 2. Low Pressure Vapor Line up to <1" diameter: 1.0" thick EPDM Flexible Elastomeric Cellular
 - 3. Liquid Line up to <1" diameter: 1.0" thick EPDM Flexible Elastomeric Cellular
- C. Condensate Drains from Cooling Coils: 1/2" EPDM Flexible Elastomeric Cellular Insulation

END OF SECTION 23 0719

SECTION 23 0800 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- B. The following HVAC equipment is to be commissioned, including commissioning activities for the following specific items:
 - 1. Control system.
 - 2. Piping systems and equipment.
 - 3. VRV systems
 - 4. Kitchen MAU, Hoods, EFs, Ansul systems
 - 5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.2 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2007

1.3 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
- C. Contractor shall draft Prefunctional Checklists and Functional Test Procedures for systems being commissioned: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
 - 1. System name.
 - 2. List of devices.
 - 3. Step-by-step procedures for testing each controller after installation, including:

- a. Process of verifying proper hardware and wiring installation.
 - b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
 - c. Process of performing operational checks of each controlled component.
 - d. Plan and process for calibrating valve and damper actuators and all sensors.
 - e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.
- D. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- E. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
 2. Full as-built set of control drawings.
 3. Full as-built sequence of operations for each piece of equipment.
 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.
 - b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.

- f. Air terminal unit tag ID.
 - g. Heating and/or cooling valve tag ID.
 - h. Minimum air flow rate.
 - i. Maximum air flow rate.
 - 5. Full print out of all schedules and set points after testing and acceptance of the system.
 - 6. Full as-built print out of software program.
 - 7. Electronic copy on disk of the entire program for this facility.
 - 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
 - 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
 - 10. Control equipment component submittals, parts lists, etc.
 - 11. Warranty requirements.
 - 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
 - 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Valves and valve actuators.
 - h. Dampers and damper actuators.
 - i. Program setups (software program printouts).
- F. Project Record Documents: See Section 01 7800 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- G. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
 2. Control system manufacturer's recommended training.
 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- H. Training Manuals: See Section 01 7900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

- A. Furnish additional information requested by the Commissioning Authority.
- B. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- C. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that

the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

- D. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- E. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
- F. Provide temperature and pressure taps in accordance with Contract Documents.
 - 1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.2 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- B. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- C. Functional Testing of the control system constitutes demonstration .
- D. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

- E. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- F. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. Add design intent documentation furnished by DEDC, LLC to manuals prior to submission to Owner.
- B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

- A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- C. Provide hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.
- D. TAB Review: Instruct Owner's personnel for minimum 2 hours, after completion of TAB, on the following:
 - 1. Review final TAB report, explaining the layout and meanings of each data type.
 - 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
 - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 - 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
 - 5. Other salient information that may be useful for facility operations, relative to TAB.

- E. Provide the services of manufacturer representatives to assist instructors where necessary.
- F. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 23 0800

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Check valves.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 09 9123 - Interior Painting.
- C. Section 23 0716 - HVAC Equipment Insulation.
- D. Section 23 0719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

- A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2013.
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.
- F. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2016.
- G. ASME B31.9 - Building Services Piping; 2014.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

- J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
- K. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.
- L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.4 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Liquid Indicators:
 - 1. Use line size liquid indicators in main liquid line leaving condenser.
 - 2. If receiver is provided, install in liquid line leaving receiver.
 - 3. Use line size on leaving side of liquid solenoid valves.
- D. Valves:
 - 1. Use service valves on suction and discharge of compressors.
 - 2. Use gauge taps at compressor inlet and outlet.
 - 3. Use check valves on compressor discharge.
 - 4. Use check valves on condenser liquid lines on multiple condenser systems.
- E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

- D. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.
- E. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- F. Test Reports: Indicate results of leak test, acid test.
- G. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- H. Submit welders certification of compliance with ASME BPVC-IX.
- I. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum _____ years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
 - 1. Fittings: ASME B16.26 cast copper.
 - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
 - 1. Provide hangers and supports that comply with MSS SP-58.

- a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
9. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
 - e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.2 REFRIGERANT

- A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
- B. Refrigerant: R410a as defined in ASHRAE Std 34.

2.3 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.4 VALVES

A. Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

B. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.5 STRAINERS

A. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.6 CHECK VALVES

A. Globe Type:

1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with piping parallel or perpendicular to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.

- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Provide clearance for installation of insulation and access to valves and fittings.
- F. Insulate pipingNone - N/A; refer to Section 230719.
- G. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5, and manufacturers recommendations.

3.4 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 2300

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Duct cleaning.

1.2 RELATED REQUIREMENTS

- A. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Cleaning ducts after completion of installation.
- B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- D. Section 23 3300 - Air Duct Accessories.
- E. Section 23 3700 - Air Outlets and Inlets.
- F. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.
- I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

- J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.
- K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.
- N. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.
- O. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.
- P. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. 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. 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. Penetrations of smoke barriers and fire-rated construction.
- D. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for All systems.
- E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

- F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.7 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. All Ducts: Galvanized steel, or Manufactured Non-Metallic Ductwork.
- C. Low Pressure Supply (System with Cooling Coils): 2 inch wg pressure class, galvanized steel.
- D. Return and Relief: 1 inch wg pressure class, galvanized steel.
- E. Kitchen Cooking Hood Exhaust: 1 inch wg pressure class, galvanized steel.

2.2 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Stainless Steel for Ducts: ASTM A666, Type 304.
- C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. VOC Content: Not more than 250 g/L, excluding water.
 - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

4. For Use with Flexible Ducts: UL labeled.
5. Manufacturers:
 - a. Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.3 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Slip and Drive ductwork joints not allowed.
- C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufactured Non-Metallic Ductwork - Rooftop ductwork only:

1. Products:

- a. Ductwork system materials including panels, adhesives, tapes, sealants, flanges and gaskets to be as a matched system listed by Underwriter's Laboratory to the UL-181 standard as a Class 1 air duct.
- b. Duct air leakage rates to be in compliance with SMACNA Class 3 HVAC Duct Construction Standards, latest version per applicable leakage class based on pressure.
- c. The panel shall be manufactured of CFC/HCFC-free rigid material thermobonded on both sides to a factory-applied .001"(25 micron) aluminum foil facing reinforced with a fiberglass scrim. The thermal conductivity shall be no greater than 0.13BTU in/hr x sq.ft x degree F(.018W/m x deg. C), and the density of the material shall not be less than 3.5 pcf(56 Kg/sq.m) with a minimum compressive strength of 28 psi (.2 MPa).
- d. The standard thermal rating to be a minimum of an R-6.0 (1.2 RSI)
- e. Installed ducting system must be warranted for a minimum of ten years from installation.

2. Application:

- a. All fabricated duct segment fittings shall be designed in accordance with SMACNA HVAC Duct Construction Standards, latest edition.

3. Duct Installation:

- a. All exterior mounted ductwork shall be protected against the elements with a non-duct penetrating weatherproof finish. Duct segments shall incorporate 6.0 mils thickness 5-ply aluminum, zero permeability, absolute vapor barrier self-adhesive jacketing. All external seams and joints shall be fully sealed with joint and seam tape during the installation process.

4. Manufacturers:

- a. Thermaduct; www.thermaduct.com
- b. Substitutions: See Section 01 6000 - Product Requirements.

B. Double Wall Insulated Round Ducts: Round spiral lockseam duct with 304 (2B finish) stainless steel outer wall, perforated SS steel inner wall; fittings with solid inner wall.

1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:

- a. Thickness: 1 inch.
 - b. Material: Fiberglass.
- C. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with 304 (2B finish) stainless steel outer wall, perforated SS steel inner wall; fittings with solid inner wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
 - 2. Insulation:
 - a. Thickness: 1 inch.
 - b. Material: Fiberglass.
- D. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
- E. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
 - 1. UL labeled.
 - 2. Maximum flexible duct length to be 6'-0" with no more than one 90 degree bend.
 - 3. Insulation: Fiberglass insulation with aluminized vapor barrier film.
 - 4. Pressure Rating: 4 inches wg positive and 0.5 inches wg negative.
 - 5. Maximum Velocity: 4000 fpm.
 - 6. Temperature Range: Minus 20 degrees F to 175 degrees F.
 - 7. Manufacturers:
 - a. Thermaflex Model M-KE.
 - b. Hart and Cooley Model F216.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- F. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
 - 1. Manufacturers:
 - a. Carlisle HVAC Products; Nexus Flange Connectors with Sealant Pocket:
www.carlislehvac.com/#sle.

- b. Ductmate Industries, Inc, a DMI Company; None - N/A: www.ductmate.com/#sle.
 - c. Elgen Manufacturing Company, Inc; None - N/A: www.elgenmfg.com/#sle.
- G. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).
- 1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company; None - N/A: www.ductmate.com/#sle.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use double nuts and lock washers on threaded rod supports.
- H. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.2 CLEANING

- A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 PRESSURE TESTING

- A. Prior to the balancing of the duct system by the AABC certified balancing contractor all ductwork shall be tested by the mechanical contractor for duct leakage in accordance with SMACNA Standards and AABC Standards Chapter 23. Duct leakage shall not exceed 1% for a duration of (10) ten minutes. Test pressures shall be as per SMACNA, however, not less than the following:

1. Low Pressure Duct:
 - a. 25% above system operating pressure, but not less than 2" w.c. (500 Pa).
- B. Insulation materials shall not be applied until systems have been witnessed to meet the above testing requirements.
- C. The testing and balancing contractor shall witness and certify all duct pressure tests.
- D. Additional leak testing requirements:
 1. Disassemble, reassemble, and seal segments of duct systems to accomodate leakage testing and for compliance with test requirements.
 2. If static pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 3. Provide seven (7) days advance notice for testing.

3.4 SCHEDULES

- A. Ductwork Pressure Class:
 1. Supply (Heating Systems): 2 inch
 2. Supply (System with Cooling Coils): 2 inch.
 3. Return Ductwork: 1 inch.
 4. General Exhaust: 1 inch.
 5. Outside Air Intake: 1 inch.
 6. Combustion Air: 1 inch (250 Pa)

END OF SECTION 23 3100

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers.
- D. Duct access doors.
- E. Duct test holes.
- F. Flexible duct connectors.
- G. Volume control dampers.

1.2 RELATED REQUIREMENTS

- A. Section 23 0548.01 - Vibration and Seismic Controls for HVAC.
- B. Section 23 3100 - HVAC Ducts and Casings.
- C. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.3 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
- D. Project Record Drawings: Record actual locations of access doors and test holes.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Krueger-HVAC, Division of Air System Components; _____: www.krueger-hvac.com/#sle.
2. PCI Industries, Inc; Pottorff Brand : www.pottorff.com.
3. Ruskin Company; _____: www.ruskin.com/#sle.
4. Titus HVAC, a brand of Johnson Controls; _____: www.titus-hvac.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc, a brand of Mestek, Inc; _____: www.louvers-dampers.com/#sle.
2. Nailor Industries, Inc; _____: www.nailor.com/#sle.
3. Ruskin Company; _____: www.ruskin.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

4. Larger Sizes: Provide an additional hinge.

- C. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
 1. Manufacturers:
 2. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal:
www.carlislehvac.com/#sle.

2.5 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
 1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric:
www.carlislehvac.com/#sle.
 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

2.6 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Louvers & Dampers, Inc, a brand of Mestek, Inc; _____: www.louvers-dampers.com/#sle.
 2. Nailor Industries, Inc; _____: www.nailor.com/#sle.
 3. Ruskin Company; _____: www.ruskin.com/#sle.
 4. Substitutions: See Section 01 6000 - Product Requirements.

- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- F. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

H. Provide air turning devices within duct whenever long radius elbows are not utilized.

END OF SECTION 23 3300

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Diffusers:
- B. Registers/grilles:
- C. Louvers:

1.2 REFERENCE STANDARDS

- A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.1 GRD MANUFACTURERS (SEE DRAWINGS FOR MODELS)

- A. Price Industries: www.price-hvac.com/#sle.
- B. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
- C. Tuttle and Bailey: www.tuttleandbailey.com/#sle.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.2 LOUVER MANUFACTURERS (SEE DRAWINGS FOR MODELS)

- A. Greenheck
- B. Ruskin
- C. Substitutions: See Section 01 6000 - Product Requirements

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.
- F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION 23 3700

SECTION 23 3810 - FIRE READY HOOD

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies fully integrated, pre-engineered fire suppression range hood systems.

1.2 DEFINITIONS

- A. Range hood, unit, kitchen hood and hood system; for purposes of this specification section, these terms all have the same definition.
- B. Residential grade fire suppression: a hood suppression system that fulfills the 300A standard, being designed to protect a residential-grade cooking appliance that is used within a commercial space.
- C. Eyebrow, compensating, short circuit hood types are not allowed.

1.3 RELATED WORK

- A. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Electrical Connections.

1.4 QUALITY CONTROL

- A. Installer Qualifications: Experienced in mechanical equipment installation or supervised by an experienced mechanical equipment installer.
 - 1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.
- B. NSF Compliance: Equipment bears NSF Certification Mark (when required)
- C. UL Listing: Equipment has been evaluated according to UL or ETL 300A and is labeled for intended use.
- D. Fire-Protection Systems: to be pre-engineered and factory integrated into the design of the hood
- E. Seismic Restraint:
 - 1. Comply with requirements in Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
 - 2. Comply with applicable guidelines for seismic restraint of kitchen equipment contained in SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Guidelines," Appendix A.
- F. In-Use Service: The manufacturer maintains that the system can be operated or maintained by any qualified maintenance technician. However, the manufacturer will offer web-based certification training by request. The manufacturer does not provide field service.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Include manufacturer's address and telephone number.
 - 2. Include catalog or model numbers, and illustrations and descriptions of ventilators and accessories.
- C. Installation Drawings: Show dimensions; method of assembly; and details of installation, adjoining construction, coordination with service utilities, and other work required for a complete installation.
- D. Field Test Reports: Indicate whether demonstration will be necessary, dates and times of tests and certify test results.
- E. Operating Instructions: Include operating instructions covering operation of all components and maintenance procedures covering proper cleaning and necessary lubrication or adjustments to controls.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ICC Evaluation Service Listing Criteria #1031 (LC1031)
- C. C. ICC Evaluation Services PMG Listing #1293 (PMG1293)
- D. UL or ETL Standard 300A

PART 2 - PRODUCTS

EXHAUST HOODS

- 2.1 BASIS OF DESIGN: ACCUREX
- 2.2 SEE RANGE HOOD SCHEDULE IN DRAWINGS FOR HOOD PERFORMANCE REQUIREMENTS
- 2.3 HOOD SHALL BE CONSTRUCTED OF 18 & 20 GAUGE (TYPE 304) POLISHED STAINLESS STEEL. HOOD SHALL HAVE FIRE SUPPRESSION SYSTEM FACTORY INSTALLED INTO THE HOOD SYSTEM. ACTIVATION OF THE MECHANICAL FIRE SUPPRESSION SYSTEM SHALL BE BY 212 OR 280-DEGREE FUSIBLE LINK (30" VS. 36" SIZES). FIRE SUPPRESSION AGENT WILL BE AMEREX 660 LOW PH WET CHEMICAL SUPPRESSANT. UNIT SHALL INCLUDE FUEL SHUTDOWN OPTION FOR GAS, ELECTRIC OR DUAL ELEMENT DEVICES. THE HOOD SYSTEM WILL ALSO HAVE MULTIPLE ALARM AND MONITORING CONTACTS FACTORY INSTALLED INTO THE HOOD
- 2.4 SYSTEM INTERCONNECTED WITH INCLUDED SHUNT TRIP BREAKER AND/OR GAS SOLENOID VALVE OF EQUIPMENT LOCATED BELOW VENTILATOR FOR POWER AND FUEL SHUTOFF DURING SYSTEM ACTUATION.
 - A. Environmental Monitoring / Internal Monitoring / Pre-Suppression
 1. Two temperature sensors are located on the inner face of the hood; one at a medium set point, the other at high. Under cooking conditions, when the medium set point is reached, the fan is turned on high. This feature dissipates the heat from the area but also draws it into the unit, past the fusible links in the system. If temperatures continue to rise and the high temperature set point is reached, the system reacts by shutting down power to the range prior to suppression system release. When this occurs, the unit's internal alarm is activated so that occupants are notified that the system is working to prevent further escalation of a potential fire. This is considered two stages of pre-suppression, where the unit is interacting with the cooking environment - working to minimize the risk of a fire event
 - a. Should temperatures continue to rise, fire is present. The fusible links will melt, mechanically actuating the suppression system and releasing a low PH wet chemical agent across the cook-top. At actuation, the system will also make a second attempt to shut down power to the range; in the event of a flash-fire, or something that happens too quickly to register with the temperature sensors. The system will continue to sound its internal alarm while also communicating a "fire code" back to a monitored alarm panel.
 - b. The PLC Self-Monitoring-System also monitors the entire suppression assembly for completeness and continuity. If the suppression system is ever compromised through a loss of pressure or broken connection, or tampering of any kind, the unit reacts by shutting down power to the range. In this case the suppression system is compromised therefor the range shouldn't be in use. Under this condition, the system communicates a separate "maintenance

code" saying that the unit is down and needs service. When preemptive shutdown occurs, the system and the cooking equipment will not come back on-line until the GRRS is reset.

B. F. Options

1. Manual Pull Station (MPK) - Mechanical assembly allowing the fire suppression system to be actuated manually normally located at the point of egress.
2. Handicapped Accessible Controls (ADA) - Separate control system designed to mirror the front-end controls of the hood, to be installed at under counter-top height.
3. Powder Coating (PC) - The hood system can be powder coated in a variety of standard colors, the manufacturer can also color match.

PART 3 - EXECUTION

3.1 INSTALLATION

- A.** Install hood system level and plumb with access clearances required for operation, maintenance and cleaning and in accordance with the manufacturer's published documentation.
1. Show on drawings overhead or rear support for equipment specified in this section.
 - a. Coordinate installation of ventilators with overhead supports
 - b. Interconnect ventilators to service utilities.
 - c. Install seismic restraints for equipment if required.

3.2 FIELD TESTING

- A.** Functional Test: using manufacturer-supplied procedure, short internal sensors to demonstrate shutdown and communication features.
- B.** Puff Test: using manufacturer supplied test cylinder, replace suppressant cylinder in system with test (nitrogen only) cylinder. Replace fusible links in line with a "test link". Cut the test link and allow the system to actuate, performing all of its standard functions.

3.3 CLEAN-UP

- A.** At completion of the installation, clean and adjust equipment as required to produce ready-for-use condition.
1. Where stainless-steel surfaces are damaged during installation procedures, repair finishes in order to match adjoining undamaged surfaces.

3.4 INSTRUCTIONS

- A. Instruct personnel and transmit operating instructions in accordance with requirements.

END OF SECTION 23 3810

SECTION 23 7499 - PACKAGED DOAS WITH ENERGY RECOVERY

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes units with integral heating and cooling for rooftop installation. Integral Energy Recovery device shall be a rotary air-to-air total enthalpy wheel. Integral heat source shall be Indirect Gas-Fired furnace. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air only. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Section 2 of this specification.

B. SUBMITTALS

1. Product Data: For each type or model include the following:
 - a. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
 - b. Sound performance data for both Supply Air and Exhaust Air, as tested in an AMCA Certified chamber.
 - c. Motor ratings, electrical characteristics and motor and fan accessories.
 - d. Performance ratings for all chilled water or DX coils.
 - e. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
 - f. Estimated gross weight of each installed unit.
 - g. Installation, Operating and Maintenance manual (IOM) for each model.
 - h. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
 - i. AHRI Certified coil performance ratings with system operating conditions indicated. Ratings shall be in accordance with Standard 410.
 - j. Energy wheel performance data for both summer and winter operation.

C. QUALITY ASSURANCE

1. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

2. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.
3. Product Options: Drawings must indicate size, profiles and dimensional requirements of unit and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".
4. Certifications
 - a. Blowers shall be AMCA Certified for air flow.
 - b. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.
 - c. Energy Wheel shall be AHRI Certified, per Standard 1060.
 - d. Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05. DX and water coils shall be AHRI Certified per standard 410-2001.
 - e. Indirect gas-fired furnace shall be ETL Certified as a component of the ERU. Indirect gas-fired furnace shall be an ETL Recognized Component of the ERU per ANSI Z83.8.

D. COORDINATION

1. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.
2. Coordinate location of water system fittings to ensure correct positioning for connection to the water coil and condensate drain pipe.
3. Coordinate sequencing of construction of associated plumbing, HVAC, electrical supply, roofing contractor.

E. EXTRA MATERIALS

1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Filters: 1 set(s) of MERV 8 disposable Supply Air and Exhaust Air filters and 1 set(s) of MERV 8 and MERV 13 disposable final filters for each unit.
 - b. One set of energy wheel belts.

F. WARRANTY

1. The mechanical contractor shall provide two (2) years maintenance, including parts, labor (including travel time), for all DOAS equipment

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
1. LG
 2. Valent Air Management Systems
 3. Mitsubishi Electric US, Inc.
- B. MANUFACTURED UNITS
1. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, exhaust air blower, evaporator coil, energy wheel, indirect gas-fired furnace, packaged DX system, phase and brownout protection, motorized dampers, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat which has dual point power.
- C. CABINET
1. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
 - a. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Components that receive a painted finish per A / E specification shall be painted with a polyester urethane powder coat.
 - b. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
 2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
 - a. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
 - 1) Thickness: 2 inch (50 mm)
 - 2) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

3. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvanized steel.
4. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.
5. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.
6. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.
7. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.
8. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.
9. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.
10. Indirect gas furnace
 - a. Shall be ETL Certified as a component of the unit.
 - b. Shall have an integral combustion gas blower.
 - c. Shall be ETL Certified for installation downstream of a cooling coil.

- d. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
 - e. Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.
 - f. Heat exchanger shall have a 10 year extended warranty.
 - g. Furnace control shall be 4:1 Modulating.
 - h. Shall be encased in a weather-tight metal housing with intake air vents. Large, metal lift-off door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.
 - i. Shall have solid state controls permitting stand-alone operation or control by building controllers.
11. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan motors shall be three phase, type 56 frame, Open Air Over and Shaft Up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.
12. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
- a. Global alarm condition (active when there is at least one alarm)
 - b. Supply Air Proving alarm
 - c. Dirty Filter Alarm
 - d. Compressor Trip alarm
 - e. Compressor Locked Out alarm

- f. Supply Air Temperature Low Limit alarm
 - 1) Sensor #1 Out of Range (outside air temperature)
 - 2) Sensor #2 Out of Range (supply air temperature)
 - 3) Sensor #3 Out of Range (cold coil leaving air temperature)
- 13. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.
- 14. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.
- 15. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in..
- 16. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A / E. Service outlet requires a dedicated single phase electric circuit. Unit contains a 120 VAC transformer to provide power to service outlet.
- 17. Hail Guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.
- 18. Vapor Tight Lights: Provide service lights mounted in the unit to be used during times of routine maintenance. The lights must be wired by others on the jobsite, as they will not be wired through the unit control center.

D. BLOWER

- 1. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.
- 2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
- 3. Fan: Airfoil plenum fan statically and dynamically balanced, AMCA certified for air and sound performance, mounted on ground and polished steel fan shafts with ball bearing pillow blocks.

Bearings shall be selected for a minimum L10 life in excess of 50,000 hours at maximum catalogued speeds.

4. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. MOTORS

1. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPA's minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.
2. Motors shall be 60 cycle, 3 phase 208 volts.

F. UNIT CONTROLS

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.
3. Unit supply fan shall be configured for Constant Volume (ON/OFF).
4. Unit exhaust fan shall be configured for building pressure by factory.
5. Outside Air / Return Air damper control shall be
6. Economizer control shall be temperature / dew point.
7. Dirty filter sensor shall be factory installed.
8. Operating protocol: The DDC shall be factory-programmed for Modbus.
9. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

10. M-NET connection: unit shall have factory installed connection hardware to interface with Mitsubishi Electric City Multi VRF systems. This hardware must enable the unit to be monitored and controlled from a remote interface that is also integrated to control the MEUS VFR systems.

G. FILTERS

1. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 and MERV 13 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- C. Proceed with installation only after all unsatisfactory conditions have been corrected.

D. INSTALLATION

1. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

E. CONNECTIONS

1. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
2. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
3. Duct installation and connection requirements are specified in Division 23 of this document.
4. Electrical installation requirements are specified in Division 26 of this document.

F. FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

G. START-UP SERVICE

1. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

H. DEMONSTRATION AND TRAINING

1. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION 23 7499

SECTION 23 8129 - VARIABLE REFRIGERANT FLOW HVAC SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. The variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system.
- B. The specification below is for general compliance. They latest Mitusibishi City Multi R32 system and equipment shall be provided as per the design drawings.

1.2 QUALITY ASSURANCE

- A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. A full charge of R-32 for the condensing unit only shall be provided in the condensing unit.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendation.

1.4 CONTROLS

- A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.
- C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
- D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.
- E. System shall be capable of email generation for remote alarm annunciation.
- F. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi Electric controls system

configuration and operation. The representative shall provide proof of certification for Mitsubishi Electric Controls Applications Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

PART 2 - WARRANTY

- 2.1 THE CITY MULTI UNITS SHALL BE COVERED BY THE MANUFACTURER'S LIMITED WARRANTY FOR A PERIOD OF ONE (1) YEAR PARTS AND SEVEN (7) YEAR COMPRESSOR TO THE ORIGINAL OWNER FROM DATE OF INSTALLATION.
- 2.2 MANUFACTURER SHALL HAVE A MINIMUM OF THIRTY-THREE (33) YEARS OF HVAC EXPERIENCE IN THE U.S. MARKET.
- 2.3 ALL MANUFACTURER TECHNICAL AND SERVICE MANUALS MUST BE READILY AVAILABLE FOR DOWNLOAD BY ANY LOCAL CONTRACTOR SHOULD EMERGENCY SERVICE BE REQUIRED. REGISTERING AND SIGN-IN REQUIREMENTS WHICH MAY DELAY EMERGENCY SERVICE REFERENCE ARE NOT ALLOWED.
- 2.4 THE CITY MULTI VRF SYSTEM SHALL BE INSTALLED BY A CONTRACTOR WITH EXTENSIVE CITY MULTI INSTALL AND SERVICE TRAINING. THE MANDATORY CONTRACTOR SERVICE AND INSTALL TRAINING SHOULD BE PERFORMED BY THE MANUFACTURER.

PART 3 - PRODUCTS

- 3.1 CITY MULTI VRF - SEE DRAWINGS FOR MODELS
- 3.2 BRANCH CIRCUIT (BC) CONTROLLERS FOR R2-SERIES SYSTEMS

A. General

1. The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.
2. The BC (Branch Circuit) Controllers shall be specifically used with R32 systems. These units shall be equipped with a circuit board that interfaces to the M-NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity. The BC Controller shall be suitable for use in plenums in accordance with UL1995 ed 4.

- a. BC Unit Cabinet:
 - 1) The casing shall be fabricated of galvanized steel.
 - (a) Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
 - (1) The unit shall house two tube-in-tube heat exchangers.
 - (b) Refrigerant
 - (1) R410A refrigerant shall be required.
 - (c) Refrigerant Branches
 - (1) All BC Controller refrigerant pipe connections shall be brazed or flared.
 - (d) Refrigerant valves:
 - (1) The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
 - (2) Each branch shall have multiple two-position valves to control refrigerant flow.
 - (3) Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
 - (4) Linear electronic expansion valves shall be used to control the variable refrigerant flow.
 - (5) Refrigerant leak detection / prevention valves will be provided
 - (e) Integral Drain Pan:
 - (1) 1. An Integral resin drain pan and drain shall be provided
 - (f) Electrical:
 - (1) The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz.
 - (2) The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).
 - (3) The BC Controller shall be controlled by integral microprocessors

- (4) The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.3

PLFY-P**NCMU-ER4 (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT

A. General:

1. The PLFY-P**NCMU-ER4 shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

a. Unit Cabinet:

- 1) The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
 - (a) The cabinet panel shall have provisions for a field installed filtered outside air intake.
 - (1) Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
 - (b) Fan:
 - (1) The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
 - (2) The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
 - (3) The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
 - (4) The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
 - (5) The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

(c) Filter:

- (1) Return air shall be filtered by means of a long-life washable filter.
- (d) Coil:
- (1) The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
 - (2) The tubing shall have inner grooves for high efficiency heat exchange.
 - (3) All tube joints shall be brazed with phos-copper or silver alloy.
 - (4) The coils shall be pressure tested at the factory.
 - (5) A condensate pan and drain shall be provided under the coil.
 - (6) The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.
 - (7) Both refrigerant lines to the PLFY indoor units shall be insulated in accordance with the installation manual.
- (e) Electrical:
- (1) The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
 - (2) The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
- (f) Controls:
- (1) This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system.
 - (2) Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
 - (3) Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F - 9.0°F adjustable deadband from set point.
 - (4) Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
 - (5) Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

3.4 GENERAL:

- A. The PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

1. Indoor Unit.

- a. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

1) Unit Cabinet:

- (a) The unit shall be, ceiling-concealed, ducted.

- (1) The cabinet panel shall have provisions for a field installed filtered outside air intake.

(b) Fan:

- (1) PEFY-NMAU models shall feature external static pressure settings from 0.14 to 0.60 in. WG.
- (2) The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
- (3) The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- (4) The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function
- (5) The indoor unit shall have a ducted air outlet system and ducted return air system.

(c) Filter:

- (1) Return air shall be filtered by means of a standard factory installed return air filter.
- (2) Optional return filter box (rear or bottom placement) with high-efficiency filter shall be available for all PEFY indoor units.

(d) Coil:

- (1) The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
- (2) The tubing shall have inner grooves for high efficiency heat exchange.
- (3) All tube joints shall be brazed with phos-copper or silver alloy.
- (4) The coils shall be pressure tested at the factory.
- (5) A condensate pan and drain shall be provided under the coil.
- (6) The condensate shall be gravity drained from the fan coil.
- (7) Both refrigerant lines to the PEFY indoor units shall be insulated in accordance with the installation manual.

(e) Electrical:

- (1) The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- (2) The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

(f) Controls:

- (1) This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
- (2) Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
- (3) Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F - 9.0°F adjustable deadband from set point.
- (4) Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
- (5) Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

PART 4 - CONTROLS

4.1 OVERVIEW

A. General:

1. The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

4.2 ELECTRICAL CHARACTERISTICS

A. General:

1. The CMCN shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.

a. Wiring:

- 1) Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
 - (a) Control wiring for the Smart ME remote controller shall be from the remote controller to the first associated indoor unit (TB-5) M-NET connection. The Smart ME remote controller shall be assigned an M-NET address.
 - (1) Control wiring for the Simple MA and Wireless MA remote controllers shall be from the remote controller (receiver) to the first associated indoor unit (TB-15) then to the remaining associated indoor units (TB-15) in a daisy chain configuration.
 - (2) Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
 - (3) The AE-200, AE-50, and EB-50GU centralized controller shall be capable of being networked with other AE-200, AE-50, and EB-50GU centralized controllers for centralized control.

(b) Wiring type:

- (1) Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.

(2) Network wiring shall be CAT-5 with RJ-45 connection.

4.3 CITY MULTI CONTROLS NETWORK

- A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.

4.4 CMCN SYSTEM CONFIGURATION

- A. CMCN: Remote Controllers Backlit Simple MA Remote Controller (PAC-YT53CRAU)

1. The Backlit Simple MA Remote Controller (PAC-YT53CRAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 3" x 5" and have limited user functionality. The Backlit Simple MA supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple MA Remote Controller shall allow the user to change on/off, mode (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple MA Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple MA Remote Controller shall display a four-digit error code in the event of system abnormality/error.
2. The Backlit Simple MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers (PAR-FL32MA-E / PAR-FA32MA-E) or with other Backlit Simple MA Remote Controllers (PAC-YT53CRAU), with up to two remote controllers per group.
3. The Backlit Simple MA Remote Controller shall require no addressing. The Backlit Simple MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The Simple MA Remote Controller shall require cross-over wiring for grouping across indoor units.
4. PAC-YT53CRAU (Backlit Simple MA Remote Controller)
5. Description Operation Display
6. ON/OFF Run and stop operation for a single group Each Group Each Group
7. Operation Mode Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only. Each Group Each Group

8. Temperature Setting Sets the temperature from 40°F - 95°F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment. Each Group Each Group
 9. Fan Speed Setting Available fan speed settings depending on indoor unit. Each Group Each Group
 10. Air Flow Direction Setting Air flow direction settings vary depending on the indoor unit model. Each Group Each Group
 11. Permit / Prohibit Local Operation Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions. N/A Each Group *1
 12. Display Indoor Unit Intake Temp Measures and displays the intake temperature of the indoor unit when the indoor unit is operating. N/A Each Group
 13. Display Backlight Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.) N/A Each Unit
 14. When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed N/A Each Unit
 15. Test Run Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display "test run"). Each Group Each Group *2
- B. Ventilation Equipment Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit. Each Group N/A
- C. Set Temperature Range Limit Set temperature range limit for cooling, heating, or auto mode. Each Group Each Group

4.5 CENTRALIZED CONTROLLER (WEB-ENABLED)

A. AE-200 Centralized Controller

1. The AE-200A Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple CITY MULTI outdoor units with the use of three (3) AE-50A expansion controllers. The AE-200A Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The AE-200A Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the AE-200A Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch

operation). This basic set of operation controls for the AE-200 Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the AE-200A provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the AE-200A Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

- a. AE-200 (Centralized Controller)
- b. Description Operation Display
- c. ON/OFF Run and stop operation. Each Block, Group or Collective Each Group or Collective
- d. Operation Mode Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only. Each Block, Group or CollectiveEach Group
- e. Temperature Setting Sets the temperature from 57°F - 87°F depending on operation mode and indoor unit. Each Block, Group or Collective Each Group
- f. Fan Speed Setting Available fan speed settings depending on indoor unit. Each Block, Group or Collective Each Group
- g. Air Flow Direction Setting Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set. *1 Each Block, Group or CollectiveEach Group
- h. Schedule Operation Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can be scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports. *2 Each Block, Group or CollectiveEach Group
- i. Optimized Start Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time. Each Block, Group or CollectiveEach Block, Group or Collective
- j. Night Setback Setting The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective. Each Group Each Group

- k. Permit / Prohibit Local Operation Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions. Each Block, Group or Collective *3 Each Group
- l. Room Temp Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface. N/A Each Group
- m. When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection N/A *4 Each Unit or Collective
- n. Outdoor Unit Status Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series) Each ODU Each ODU
- o. Connected Unit Information MNET addresses of all connected systems Each IDU, ODU and BC Each IDU, ODU and BC
- p. Ventilation Equipment This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation". Each Group Each Group
- q. Multiple Language Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available. N/A Collective
- r. External Input / Output By using accessory cables you can set and monitor the following. Input By level: "Batch start/stop", "Batch emergency stop" By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately. *5 Collective *5 Collective
 - 1) All AE-200A Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three AE-50A expansion controllers for display of up to two hundred (200) indoor units on the main AE-200A interface.
 - 2) The AE-200A Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

- 3) Standard software functions shall be available so that the building manager can securely log into each AE-200A via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs and Tenant Billing shall be available but are not included. The Tenant Billing function shall require TG-2000 Integrated System software in conjunction with the Centralized Controllers.

4.6 HVAC GUIDE SPECIFICATIONS

4.7 EXECUTION

PART 1- INSTALLATION

5.1 GENERAL:

- A. Rig and install in full accordance with manufacturer's requirements, project drawings, and contract documents. Refer to the manufacturer's installation manual for full requirements.

5.2 B. LOCATION:

- A. Locate indoor and outdoor units as indicated on drawings. Provide service clearance per manufacturer's installation manual. Adjust and level outdoor units on support structure.
- B. For climates that experience snowfall, mount the outdoor unit a minimum of 12" above the average snowfall line. In climates where this height requirement proves unfeasible, the outdoor units may be installed at the average snowfall line provided regular snow removal in the area surrounding the units keeps the snow line below the bottom of the units.

5.3 C. COMPONENTS / PIPING:

- A. Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer's installation manual for full instructions.
- B. Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.
- C. Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.
 1. Refrigerant pipe for CITY MULTI shall be made of phosphorus deoxidized copper, and has two types.
 - a. A. ACR "Annealed": Soft copper pipe, can be easily bent with human's hand.
 - 1) B. ACR "Drawn Temper": Hard copper pipe (Straight pipe), being stronger than Type-O pipe of the same radical thickness.

- (a) The maximum operation pressure of R410A air conditioner is 4.30 MPa [623psi] . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications in Mitsubishi Electric's engineering manual. Pipes of radical thickness 0.7mm or less shall not be used.
- (1) Flare connection should follow dimensions provided in manufacturer's installation manuals.

5.4 D. INSULATION:

- A. Refrigerant lines, as well as any valves, shall be insulated end to end with ½" closed-cell pipe insulation for piping up to 1" in diameter, or ¾" for piping 1-1/8" and larger, with a thermal conductivity no greater than 0.27 BTU-in/hr sq.ft oF. If state or local codes require insulation other than that specified above, the greater insulation shall be used.

5.5 E. ELECTRICAL:

- A. Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 (Master Format 2004) or Division Section 16 (Master Format 1995) for additional information.

5.6 F. THIRD PARTY CONTROLS:

- A. Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

5.7 HVAC GUIDE SPECIFICATIONS

5.8 SERVICE

PART - 1 ONE (1) MAINTENANCE TOOL SOFTWARE AND MN-CONVERTER (CMS-MNG-E) SHALL BE PROVIDED TO THE OWNER AS PART OF THIS PROJECT. MAINTENANCE TOOL SOFTWARE AND MN-CONVERTER (CMS-MNG-E):

6.1 THE MAINTENANCE TOOL, VIA THE MN-CONVERTER (CMS-MNG-E), SHALL ENABLE THE USER TO MONITOR AND RECORD THE FOLLOWING PARAMETERS IN A CENTRALIZED SYSTEM.

- A. Outdoor Unit
 - 1. Operation Mode (Cooling Only, Heating Only, Cooling Main, Heating Main)
 - 2. Compressor Frequency, amperages, and voltages
 - 3. Compressor high- and low-side pressure
 - 4. System Temperatures

5. Outdoor temperature
6. Status of reversing valve
 - a. BC Controller
 - 1) Valve ON/OFF status
 - (a) Temperatures
 - (1) Pressures
 - (2) Indoor Unit
 - (3) Entering Air Temperature
 - (4) Entering/Leaving Refrigerant Temperature
 - (5) Superheat/Subcool temperatures
 - (6) LEV position
 - (7) Room temperature setpoint
 - (8) Unit Mode and Status (Heat, Cool, Dry, Auto, Fan)
 - (9) The Maintenance Tool shall have the additional feature of controlling the following system components manually:
 - (10) Indoor Unit
 - (11) Indoor Unit ON/OFF
 - (12) Mode (Heat, Cool, Dry, Auto, Fan)
 - (13) Room Temperature Setpoint
 - (14) Fan speed
 - (15) LEV Position
 - (16) BC Controller
 - (17) Valve OPEN/CLOSE
 - (18) LEV Position
 - (19) The Maintenance Tool shall be connectable to either the TB3 or TB7 communication bus lines on the MNET via alligator connectors.

(20) The Maintenance Tool shall be connectable to a PC via a USB cable.

(21) Trended data from Maintenance Tool shall be available to export to a data file for offline analysis.

END OF SECTION 23 8129

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Service entrance cable.
- D. Metal-clad cable.
- E. Wire and cable for 600 volts and less.
- F. Wiring connectors.
- G. Electrical tape.
- H. Heat shrink tubing.
- I. Oxide inhibiting compound.
- J. Wire pulling lubricant.
- K. Cable ties.
- L. Firestop sleeves.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 0533.13 - Conduit for Electrical Systems: Additional installation requirements for cables installed in conduit systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

1.3 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2015).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2016.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.
- K. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
- L. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
- M. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.
- N. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- Q. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- R. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- S. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- T. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

- U. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.
- V. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- W. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify DEDC, LLC and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Concealed Dry Interior Locations: Use only building wire in raceway or metal clad cable.
- D. Exposed Dry Interior Locations: Use only building wire in raceway.
- E. Above Accessible Ceilings: Use only building wire in raceway or metal clad cable.
- F. Wet or Damp Interior Locations: Use only building wire with Type UF insulation in raceway.
- G. Exterior Locations: Use only building wire with Type THWN-2 insulation in raceway.
- H. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- I. Use stranded conductors for control circuits.
- J. Use conductor not smaller than 12 AWG for power and lighting circuits.
- K. Use conductor not smaller than 14 AWG for control circuits.
- L. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
 - 1) Services: Copper conductors size 1/0 AWG and larger.
 - 2) Feeders: Copper conductors size 1/0 AWG and larger.
 - b. Where aluminum conductors are substituted for copper, comply with the following:
 - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
 - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
 - 3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
 - 4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
 - 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- J. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:

- 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 2. Control Circuits: 14 AWG.
 - K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - L. Conductor Color Coding:
 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. Travelers for 3-Way and 4-Way Switching: Pink.
 - d. For control circuits, comply with manufacturer's recommended color code.
- 2.3 SINGLE CONDUCTOR BUILDING WIRE
- A. Manufacturers:
1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation; ____: www.generalcable.com/#sle.

- d. Southwire Company: www.southwire.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Description: Single conductor insulated wire.
 - C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
 - D. Insulation Voltage Rating: 600 V.
 - E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.
 - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
 - 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.
 - F. Conductor: Copper.
 - G. Insulation Voltage Rating: 600 volts.
 - H. Insulation: NFPA 70 , Type THHN/THWN.
 - I. Insulation: Thermoplastic material rated 75 degrees C.
- 2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE
 - A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
 - B. Provide equipment grounding conductor unless otherwise indicated.
 - C. Conductor Stranding:

- 1. Size 10 AWG and Smaller: Solid.
- 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Cable Jacket: Listed and labeled as sunlight resistant.

2.5 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide dedicated neutral conductor for each phase conductor where indicated or required.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Armor: Steel, interlocked tape.
- I. Description: NFPA 70, Type MC.
- J. Conductor: Copper.
- K. Insulation Voltage Rating: 600 volts.
- L. Insulation Temperature Rating: 75 degrees C.
- M. Insulation Material: Thermoplastic.
- N. Armor Material: Steel.
- O. Armor Design: Interlocked metal tape.

2.6 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
 - 3. Connectors for Aluminum Conductors: Use compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.

- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.7 ACCESSORIES

A. Electrical Tape:

- 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
- 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
- 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
- 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
- 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

- F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that raceway installation is complete and supported.
- E. Verify that field measurements are as indicated.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.

- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- F. Install metal-clad cable (Type MC) in accordance with NECA 120.
- G. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- H. Exposed Cable Installation (only where specifically permitted):
 - 1. Route cables parallel or perpendicular to building structural members and surfaces.
 - 2. Protect cables from physical damage.
- I. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- J. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- K. Terminate cables using suitable fittings.
 - 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- L. Install conductors with a minimum of 12 inches of slack at each outlet.

- M. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- N. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- O. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- P. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- Q. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

- b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
- 3. Wet Locations: Use heat shrink tubing.
- R. Insulate ends of spare conductors using vinyl insulating electrical tape.
- S. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- T. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment.
- U. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- V. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- W. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- X. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
- Y. Use wiring methods indicated.
- Z. Pull all conductors into raceway at same time.
- AA. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- BB. Protect exposed cable from damage.
- CC. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- DD. Use suitable cable fittings and connectors.
- EE. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- FF. Clean conductor surfaces before installing lugs and connectors.
- GG. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

- HH. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- II. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- JJ. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- KK. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform field inspection and testing in accordance with Section 01 4000.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- E. Correct deficiencies and replace damaged or defective conductors and cables.
- F. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Grounding and bonding components.
- G. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Existing metal underground water pipe.
 - 2. Metal underground water pipe.
 - 3. Metal frame of the building.
 - 4. Metal underground gas piping system.
 - 5. Rod electrodes.

1.2 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
 - 1. Includes oxide inhibiting compound.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 03 3000 - Cast-in-Place Concrete.
- D. Section 26 3100 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.
- E. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by DEDC, LLC. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- E. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):

- a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- F. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
8. Provide bonding for metal building frame.
9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

I. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Photovoltaic Systems: Also comply with Section 26 3100.

K. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
 - B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 - C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 - E. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
 - F. Oxide Inhibiting Compound: Comply with Section 26 0519.
- 2.3 MANUFACTURERS
- A. Cooper Power Systems, a division of Cooper Industries: www.cooperindustries.com.
 - B. Substitutions: See Section 01 6000 - Product Requirements.

2.4 ELECTRODES

A. Manufacturers:

1. Cooper Power Systems, a division of Cooper Industries: www.cooperindustries.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Rod Electrodes: Copper-clad steel.

1. Diameter: 3/4 inch.
2. Length: 10 feet.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.5 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
- D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.
- F. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- G. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- H. Provide bonding to meet requirements described in Quality Assurance.
- I. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- F. Conduit and equipment supports.
- G. Anchors and fasteners.

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: Comply with Section 26 0548.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Comply with MFMA-4.
 2. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
 - c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
 - e. Outlet Boxes: 1/4 inch diameter.
 - f. Luminaires: 1/4 inch diameter.

G. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

2.2 MANUFACTURERS

- A. Thomas & Betts Corporation: www.tnb.com.
- B. Threaded Rod Company: www.threadedrod.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.3 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:

ANCHOR HARDWARE TABLE

- D. Formed Steel Channel:
 - 1. Product: Steel "U" shaped with in-turned clamping ridges manufactured by Unitstrut, Power Wtrut, B-Line Strut or Kindorf.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by DEDC, LLC, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by DEDC, LLC, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide required vibration isolation and/or seismic controls in accordance with Section 26 0548.
- H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Conduit Support and Attachment: Also comply with Section 26 0533.13.
- J. Box Support and Attachment: Also comply with Section 26 0533.16.
- K. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
- L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- M. Secure fasteners according to manufacturer's recommended torque settings.
- N. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.
- E. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 2. Do not drill or cut structural members.
- F. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

- H. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-5/8" off wall.
- I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 0529

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible metal conduit (FMC).
- B. Liquidtight flexible metal conduit (LFMC).
- C. Electrical metallic tubing (EMT).
- D. Rigid polyvinyl chloride (PVC) conduit.
- E. Liquidtight flexible nonmetallic conduit (LFNC).
- F. Conduit fittings.
- G. Accessories.
- H. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 8400 - Firestopping.
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- J. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2018.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 2. Within Slab Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 3. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- N. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
 - c. Genset.
 - d. Mechanical HVAC equipment
- O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.2 CONDUIT REQUIREMENTS

- A. Electrical Service Conduits: Also comply with Section 26 2100.
- B. Communications Systems Conduits: Also comply with Section 27 1000.
- C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
 - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 - 6. Underground, Exterior: 1 inch (27 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. _____.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

D. Conduit Size: Comply with NFPA 70.

1. Minimum Size: 3/4 inch unless otherwise specified.

- E. Outdoor Locations Above Grade: Use rigid steel conduit.
- F. In Slab Above Grade:
 - 1. Use rigid steel conduit.
 - 2. Maximum Size Conduit in Slab: 3/4 inch; 1/2 inch for conduits crossing each other.
- G. Wet and Damp Locations: Use rigid steel conduit.
- H. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing, where permitted by the NEC.
 - 2. Exposed: Use electrical metallic tubing, where permitted by the NEC.

2.5 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedtube.com.
 - 2. Wheatland Tube Company: www.wheatland.com.
 - 3. Triangle
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.6 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
 - 2. Robroy Industries; _____: www.robroy.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. PVC-Coated Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.

2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.7 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com/#sle.
2. Electri-Flex Company; _____: www.electriflex.com/#sle.
3. International Metal Hose; _____: www.metalhose.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:

1. Manufacturers:

- a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
- b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
- c. Thomas & Betts Corporation: www.tnb.com/#sle.
- d. Substitutions: See Section 01 6000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

2.8 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com/#sle.
 2. Electri-Flex Company; _____: www.electriflex.com/#sle.
 3. International Metal Hose; _____: www.metalhose.com/#sle.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction with PVC jacket.
- E. Fittings: NEMA FB 1.
- 2.9 ELECTRICAL METALLIC TUBING (EMT)
- A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 3. Triangle
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

D. Description: ANSI C80.3; galvanized tubing.

E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. Cantex Inc: www.cantexinc.com/#sle.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
3. JM Eagle: www.jmeagle.com/#sle.
4. _____.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- G. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
14. Group parallel conduits in the same area together on a common rack.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 0548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

I. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

J. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

K. Underground Installation:

1. Provide trenching and backfilling in accordance with Section 31 2316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 36 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

- L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 - 3. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 - 1. Where conduits pass from outdoors into conditioned interior spaces.
 - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding in accordance with Section 26 0526.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

- B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
- C. Install steel conduit as specified in NECA 101.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Group related conduits; support using conduit rack. Construct rack using steel channel .
- G. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.
- H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- I. Do not attach conduit to ceiling support wires.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route conduit parallel and perpendicular to walls.
- L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- M. Route conduit in and under slab from point-to-point.
- N. Maintain adequate clearance between conduit and piping.
- O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- P. Cut conduit square using saw or pipecutter; de-burr cut ends.
- Q. Bring conduit to shoulder of fittings; fasten securely.
- R. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
- S. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
- T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic.
- V. Provide suitable pull string in each empty conduit except sleeves and nipples.
- W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- X. Ground and bond conduit under provisions of Section 26 0526.

Y. Identify conduit under provisions of Section 26 0553.

3.6 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section 01700.

END OF SECTION 26 0533.13

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Wall and ceiling outlet boxes.
- F. Pull and junction boxes.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- F. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Additional requirements for locating boxes for wiring devices.
- I. Section 27 1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; 2013.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for underground handhole enclosures, underground handhole enclosures, underground handhole enclosures, and underground handhole enclosures.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Use shallow boxes where required by the type of wall construction.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Wall Plates: Comply with Section 26 2726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Back Panels: Painted steel, removable.
 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

2.2 MANUFACTURERS

- A. Appleton Electric: www.appletonelec.com.
- B. Hoffman
- C. Steel City
- D. Crouse-Hinds
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.3 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.4 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
 1. Material: Galvanized cast iron.
 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - b. Communications Systems Outlets: Comply with Section 27 1000.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- I. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide required seismic controls in accordance with Section 26 0548.
 3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.

- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- P. Close unused box openings.
- Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- R. Provide grounding and bonding in accordance with Section 26 0526.
- S. Identify boxes in accordance with Section 26 0553.
- T. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- U. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- V. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- W. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- X. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- Y. Maintain headroom and present neat mechanical appearance.
- Z. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

- AA. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- BB. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- CC. Use flush mounting outlet box in finished areas.
- DD. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- EE. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- FF. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- GG. Do not fasten boxes to ceiling support wires.
- HH. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- II. Use gang box where more than one device is mounted together. Do not use sectional box.
- JJ. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- KK. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.4 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.5 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.
- B. Clean exposed surfaces and restore finish.

END OF SECTION 26 0533.16

SECTION 26 0548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Seismic restraint systems.

1.2 RELATED REQUIREMENTS

- A. Section 01 4533 - Code-Required Special Inspections and Procedures.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.3 DEFINITIONS

- A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2017.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).
- I. MFMA-4 - Metal Framing Standards Publication; 2004.
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
- 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
- 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
- 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
- 5. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
 1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify mounting conditions required for equipment seismic qualification.
 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 6. Indicate locations of seismic separations where applicable.
- F. Manufacturer's detailed field testing and inspection procedures.
- G. Field quality control test reports.

1.7 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation:
 - 1. Transformers:
 - a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
 - b. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.

2. Engine Generators:

- a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
- b. Seismic Applications: Use seismic type restrained spring isolators.
- c. Provide vibration-isolated concrete inertia bases where indicated.
- d. Minimum Static Deflection:
 - 1) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E. Conduit Isolation:

- 1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
 - a. Minimum Length: 3 feet unless otherwise indicated.
- 2. Vibration Isolators:
 - a. Provide vibration isolators for conduit supports:
 - b. Minimum Static Deflection:
 - 1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
 - 2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
 - c. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
 - d. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.2 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: ICC (IBC).

- C. Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
 - 1. Electrical components required to function for life safety purposes after an earthquake.
 - 2. Electrical components that support or otherwise contain hazardous substances.
- D. Seismic Qualification of Equipment:
 - 1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 - 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
 - 3. Notify DEDC, LLC and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
 - 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.
- E. Seismic Restraints:
 - 1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Seismic Restraint Exemptions:
 - a. Exemptions for Seismic Design Category C:
 - 1) Electrical components where either of the following apply:
 - (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
 - (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
 - b. Exemptions for Seismic Design Category D, E, and F:
 - 1) Discrete electrical components that are positively attached to the structure where either of the following apply:
 - (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the

component and associated ductwork, piping, and conduit, and the component importance factor (I_p) is 1.0.

- (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.

c. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:

- 1) Raceways with component importance factor (I_p) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
 - (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
 - (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
 - (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
 - (d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.
- 2) Conduits less than 2-1/2 inch trade size.

d. Lighting Exemptions, All Seismic Design Categories:

- 1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.
 - 2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.
3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:

- a. ASHRAE (HVACA).
 - b. FEMA 413.
 - c. FEMA E-74.
 - d. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
 - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
 - a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
 - c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
 - e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.

- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

F. Seismic Attachments:

- 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
- 3. Do not use power-actuated fasteners.
- 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
- 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- 6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

- 1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
- 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

3. Comply with minimum clearance requirements between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

H. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.

2.3 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

2.4 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.5 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

- A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- B. Seismic Snubbing Elements:
 - 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.6 SEISMIC RESTRAINT SYSTEMS

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or DEDC, LLC in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
 - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
 - 2. Verification of required clearances between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.
- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.

- b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 6. Adjust isolators to be free of isolation short circuits during normal operation.
 - 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- G. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 - 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.

- b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

6. Seismic Restraint Systems:

- a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
- b. Install restraints within permissible angles in accordance with seismic design.
- c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
- d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- D. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify required clearance beneath vibration-isolated equipment support bases.
 - 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- E. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 0548

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Large Device Identification.
- C. Nameplates and Labels.
- D. Wire and cable markers.
- E. Voltage markers.
- F. Underground warning tape.
- G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.
- B. Section 09 9123 - Interior Painting.
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- E. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.
- F. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- G. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.
- H. Section 27 10 00 - Data & Voice Communications Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

- 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

- B. Sequencing:

- 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify ampere rating.

- 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- b. Enclosed switches, circuit breakers, and motor controllers:
- 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- c. Time Switches:
- 1) Identify load(s) served and associated circuits controlled. Include location.
- d. Transfer Switches:
- 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
- a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
 5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Elevator control panels.
 6. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
- C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
 2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.

- a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
 - 1) Color Code:
 - (a) Emergency Power System: Red.
 - 2) Field-Painting: Comply with Section 09 9123 and 09 9113.
 - 3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
- 3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
- 4. Use underground warning tape to identify underground raceways.
- E. Identification for Cable Tray: Comply with Section 26 0536.
- F. Identification for Boxes:
 - 1. Use voltage markers to identify highest voltage present.
 - 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
 - 3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
- G. Identification for Devices:
 - 1. Identification for Communications Devices: Comply with Section 27 10 00.
 - 2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
 - 3. Use identification label to identify fire alarm system devices.
 - 4. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.2 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.

- B. Substitutions: See Section 01 6000 - Product Requirements.

2.3 LARGE DEVICE IDENTIFICATION

- A. Identify all disconnect switches, pull boxes, junction boxes (larger than 4" X 4") in unfinished areas with Brady voltage markers, catalog #B-498, series #44xxx (xxx indicates last 3 numbers of model number which vary based on voltage, size, etc. Contractor shall coordinate this information prior to ordering). Sizes for each label shall be as large as possible, style "A", "B" or "C" as the device permits.
- B. Identify all disconnect switches, pull boxes, junction boxes (larger than 4" X 4") finished with black engraved lamicoid self-adhesive labels, 1" X 4". The label shall state the power feed, circuit or section number, and the equipment identification number that the large device serves.

2.4 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:

1. Manufacturers:
 - a. Brimar Industries, Inc: www.brimar.com/#sle.
 - b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
 - c. Seton Identification Products; _____: www.seton.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

- B. Identification Labels:

1. Manufacturers:

- a. Brady Corporation; _____: www.bradyid.com/#sle.
 - b. Brother International Corporation: www.brother-usa.com/#sle.
 - c. Panduit Corp: www.panduit.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend:
 - a. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch.
 5. Color:
 - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
 1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/4 inch.
 5. Color: Black text on white background unless otherwise indicated.
 - a. Exceptions:

- 1) Provide white text on red background for general information or operational instructions for emergency systems.

E. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

F. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

H. Nameplates: Engraved three-layer laminated plastic, black letters on white background, 2" by 6" in size

I. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Disconnect Switches
3. Panelboards.

J. Letter Size:

1. Use 1/8 inch letters for identifying individual equipment and loads.

- K. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

2.5 WIRE AND CABLE MARKERS

- A. Manufacturers:

1. Brady Bradysleeve Catalog #B-320 PVC.
2. Substitutions: See Section 01 6000 - Product Requirements.

- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

- D. Legend: Power source and circuit number or other designation indicated.

- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

- F. Minimum Text Height: 1/8 inch.

- G. Color: Black text on white background unless otherwise indicated.

- H. Locations: Each conductor at pull boxes, junction boxes, and Termination or connection points including each load connection.

- I. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.6 VOLTAGE MARKERS

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

- C. Minimum Size:

1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".

E. Color: Black text on orange background unless otherwise indicated.

F. Location: Furnish markers for each conduit longer than 6 feet.

G. Spacing: 20 feet on center.

2.7 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; _____: www.seton.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.8 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. Devices: Outside face of cover.

- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 0553

SECTION 26 0583 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 0533.13 - Conduit for Electrical Systems.
- C. Section 26 0533.16 - Boxes for Electrical Systems.
- D. Section 26 2726 - Wiring Devices.
- E. Section 26 2816.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required.
 - 2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

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

- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 2726.
- D. Flexible Conduit: As specified in Section 26 0533.13.
- E. Wire and Cable: As specified in Section 26 0519.
- F. Boxes: As specified in Section 26 0533.16.

2.2 EQUIPMENT CONNECTIONS

- A. VRF UNITS
- B. Unit heaters
- C. DOAS Unit
- D. Kitchen Exhaust Hoods
- E. Kitchen Exhaust Fans
- F. NO/CO systems
- G. Electric Hot Water heaters

- H. All electrical systems
- I. All mechanical equipment stand-alone control equipment

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 26 0583

SECTION 26 0923 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Lighting Controls
2. Related Sections:
 - a. Section [265100 - Interior Lighting] Luminaires
 - b. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
 - c. Electrical Sections, including wiring devices, apply to the work of this Section.
3. Control Intent – Control Intent includes, but is not limited to:
 - a. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
 - b. Initial sensor and switching zones
 - c. Initial time switch settings

1.2 REFERENCES

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org <<http://www.ansi.org>> and www.ieee.org)
- B. International Electrotechnical Commission (IEC) (www.iec.ch <<http://www.iec.ch>>)
- C. International Organization for Standardization (ISO) (www.iso.ch <<http://www.iso.ch>>):
- D. National Electrical Manufacturers Association (NEMA) (www.nema.org <<http://www.nema.org>>)
- E. WD1 (R2005) - General Color Requirements for Wiring Devices.
- F. Underwriters Laboratories, Inc. (UL) (www.ul.com <<http://www.ul.com>>):
 1. 916 – Energy Management Equipment

1.3 SYSTEM DESCRIPTION & OPERATION

- A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Lighting Management local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
2. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
3. Digital Fixture Controllers – Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.
4. Digital Occupancy Sensors – Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
5. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
6. RGBW Controllers - used to control color changing lighting fixtures and providing led light shows for DMX lighting networks.

1.4 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local energy codes are more stringent, provide a minimum application of lighting controls as follows:
 1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces as shown on plan drawings.
 2. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - a. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - b. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
 - c. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
 - d. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy /

vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

3. RGBW Lighting Fixtures - Provide RGBW controller with local controls for turning on/off lighting shows in configurations as shown on plans.

1.5 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
- B. Shop Drawings:
 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 2. Show exact location of all digital devices, including at minimum sensors, load controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)
 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
 4. Product Data: Catalog sheets, specifications and installation instructions.

1.6 QUALITY ASSURANCE

1.7 MANUFACTURER: MINIMUM 10 YEARS EXPERIENCE IN MANUFACTURE OF LIGHTING CONTROLS.

1.8 PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 1. Ambient temperature: 0° to 40° C (32° to 104° F).
 2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

- A. Provide a five year limited manufacturer's warranty on all room control devices and panels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 1. Leviton
 - a. System: GreenMax

- b. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

- 2. Or approved equal

2.2 DIGITAL LIGHTING CONTROLS

- A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

2.3 LOCAL NETWORK (ROOM NETWORK)

- A. The local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
- B. Features of the local network include:
 - 1. automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 - 2. Simple replacement of any device in the local network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
 - 3. Push n' Learn™ configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 - 4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
 - 5. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
 - 6. If manufacturer's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

2.4 DIGITAL LOAD CONTROLLERS (ROOM AND FIXTURE CONTROLLERS)

- A. Digital controllers for lighting loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room load controllers shall be provided to match the room lighting load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
 - a. Device has power
 - b. Quick installation features including:
 - 1) Standard junction box mounting
 - 2) Quick low voltage connections using standard RJ-45 patch cable
 - c. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - 1) Turn on to 100%
 - 2) Turn off
 - 3) Turn on to last level
 - d. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:
 - 1) Auto-on/Auto-off (Follow on and off)
 - 2) Manual-on/Auto-off (Follow off only)
 - e. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
 - f. UL 2043 plenum rated
 - g. Manual override and LED indication for each load
 - h. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load.
 - i. Zero cross circuitry for each load

- j. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- 5. On/Off Room Controllers shall include:
 - a. One, two or four relay configuration
 - b. Efficient 150 mA switching power supply
 - c. Three RJ-45 local network ports with integral strain relief and dust cover
- 6. On/Off/Dimming enhanced Room Controllers shall include:
 - a. Real time current monitoring
 - b. Multiple relay configurations
 - 1) One, two or four relays
 - c. Efficient 250 mA switching power supply
 - d. Four RJ-45 Lighting Management local network ports with integral strain relief and dust cover
 - e. One dimming output per relay
 - 1) 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting.
 - 2) Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads.
 - 3) Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
 - 4) The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - 5) Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.

- 6) Calibration and trim levels must be set per output channel.
- 7) Devices that set calibration or trim levels per controller are not acceptable.
- 8) All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- f. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
- g. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
- h. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 1) Establish preset level for each load from 0-100%
 - 2) Set high and low trim for each load
 - 3) Set lamp burn in time for each load up to 100 hours
- i. Override button for each load provides the following functions:
 - 1) Press and release for on/off control
 - 2) Press and hold for dimming control
- 7. Fixture Controllers shall include:
 - a. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
 - b. One 3A 120/277V rated mechanically held relay.
 - c. Programmable behavior on power up following the loss of normal power:
 - 1) Turn on to 100%
 - 2) Turn off
 - 3) Turn on to last level
 - d. Requirement for 7 mA of 24VDC operating power from the GreenMax local network.

- 1) The Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the Lighting Management local network to drive accessory devices.
- e. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
- f. Terminals to connect an RJ-45 adaptor with 24" leads, mountable in a 1/2" KO, for connection to the Lighting Management local network.
 - 1) The adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
- g. A complete set of dimming features described above in the section detailing On/Off/Dimming Enhanced Room Controllers (subsection C.5 onward).

2.5 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the GreenMax local network.
 - g. Programmable control functionality including:
 - 1) Each sensor may be programmed to control specific loads within a local network.
 - 2) Sensor shall be capable of activating one of 16 user-definable lighting scenes.

- 3) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - 4) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 5) Ultrasonic and Passive Infrared
 - 6) Ultrasonic or Passive Infrared
 - 7) Ultrasonic only
 - 8) Passive Infrared only
 - 9) Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - h. One or two RJ-45 port(s) for connection to Lighting Management local network.
 - i. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 - j. Device Status LEDs, which may be disabled for selected applications, including:
 - 1) PIR detection
 - 2) Ultrasonic detection
 - 3) Configuration mode
 - 4) Load binding
 - k. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - l. Manual override of controlled loads.
 - m. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
2. Units shall not have any dip switches or potentiometers for field settings.
 3. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology lighting management local network. No additional configuration will be required.

2.6 DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 - 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the GreenMax local network.
 - g. Programmable control functionality including:
 - 1) Each sensor may be programmed to control specific loads within a local network.
 - 2) Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - 3) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - 4) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - (a) Ultrasonic and Passive Infrared
 - (b) Ultrasonic or Passive Infrared
 - (c) Ultrasonic only
 - (d) Passive Infrared only
 - h. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - i. Two RJ-45 ports for connection to Lighting Management local network.

- j. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 - k. Device Status LEDs including
 - 1) PIR detection
 - 2) Ultrasonic detection
 - 3) Configuration mode
 - 4) Load binding
 - l. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
 - m. Assignment of local buttons to specific loads within the room without wiring or special tools
 - n. Manual override of controlled loads
 - o. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- 2. Units shall not have any dip switches or potentiometers for field settings.
 - 3. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology lightning management local network. No additional configuration will be required.
 - 4. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
 - a. Left button
 - 1) Press and release - Turn load on
 - 2) Press and hold - Raise dimming load
 - b. Right button
 - 1) Press and release - Turn load off
 - 2) Press and hold - Lower dimming load
 - 5. Low voltage momentary pushbuttons shall include the following features:
 - a. Load/Scene Status LED on each switch button with the following characteristics:
 - 1) Bi-level LED

- 2) Dim locator level indicates power to switch
- 3) Bright status level indicates that load or scene is active
- b. The following button attributes may be changed or selected using a wireless configuration tool:
 - 1) Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - 2) Individual button function may be configured to Toggle, On only or Off only.
 - 3) Individual scenes may be locked to prevent unauthorized change.
 - 4) Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - 5) Ramp rate may be adjusted for each dimmer switch.
 - 6) Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.7 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 3. Configuration LED on each switch that blinks to indicate data transmission.
 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - e. Programmable control functionality including:
 - 1) Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

- 2) Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
- f. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
5. Two RJ-45 ports for connection to Lighting Management local network.
6. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology lighting management local network. No additional configuration shall be required to achieve multi-way switching.
7. The following switch attributes may be changed or selected using a wireless configuration tool:
8. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - a. Individual button function may be configured to Toggle, On only or Off only.
 - b. Individual scenes may be locked to prevent unauthorized change.
 - c. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - d. Ramp rate may be adjusted for each dimmer switch.
 - e. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependant; each button may be bound to multiple loads.

2.8 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
 1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
 4. Digital daylighting sensors shall include the following features:

- a. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
- b. Sensor light level range shall be from 1-6,553 footcandles (fc).
- c. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
- d. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
- e. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
- f. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
- g. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
- h. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
- i. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
- j. Configuration LED status light on device that blinks to indicate data transmission.
- k. Status LED indicates test mode, override mode and load binding.
- l. Recessed switch on device to turn controlled load(s) ON and OFF.
- m. One RJ-45 port for connection to GreenMax local network.
- n. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness. Extended tube photosensors accommodate mounting materials from 0.62"-1.25"

thickness. Mounting brackets are compatible with J boxes and wall mounting. Photosensor to be mounted on included bracket below skylight well.

- o. Any load or group of loads in the room can be assigned to a daylighting zone
 - p. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
 - q. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- 5. Closed loop digital photosensors shall include the following additional features:
 - a. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 - b. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 - c. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
- 6. Open loop digital photosensors shall include the following additional features:
 - a. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
 - b. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
 - c. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.

2.9 HANDHELD AND COMPUTER CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of lighting management local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:

1. Two-way infrared (IR) communication with lighting management IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify Lighting Management devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

2.10 RGBW LED LIGHTING CONTROLLERS

A. Acceptable Manufacturer:

1. ColorKinetics
 - a. System: lplayer3
2. Or approved Equal

B. Parts:

1. Provide all hardware components, lighting control devices, wiring devices and power packs as required for 100% complete system functionality.

2.11 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all Lighting Management products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
- B. Additional parameters exposed through this method include but are not limited to:

1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
10. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
 - a. Device list report: All devices in a project listed by type.
 - b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
 - c. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
 - d. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
 - e. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
 - f. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.

PART 3 EXECUTION

3.1 PRE-INSTALLATION MEETING

- A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
 - 1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
 - 2. Review the specifications for low voltage control wiring and termination.
 - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
 - 4. Discuss requirements for integration with other trades.

3.2 CONTRACTOR INSTALLATION AND SERVICES

- A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.
- B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results.
- C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.
- D. Calibrate all LED color changing lighting controllers and lighting control devices after installation. Provide lighting show settings in controller to the owner's satisfaction. Provide all lighting control software as required to make LED color changing control systems 100% complete and operational.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
 - 1. Adjust time delay so that controlled area remains lighted while occupied.
 - 2. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - a. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - b. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

- c. Load Parameters (e.g. blink warning, etc.)
- 3. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.3 FACTORY SERVICES

- A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.
- B. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
- C. Upon completion of the RGBW LED lighting and RGBW controller installation, the lighting control manufacturer's factory authorized representative shall start up and verify complete fully functional system. System shall be setup with no less than 10 color shows installed in controller as coordinated with owner in field.
- D. Upon completion of the RGBW LED lighting and RGBW controller system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION 26 0923

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.2 RELATED REQUIREMENTS

- A. Section 26 0533.16 - Boxes for Electrical Systems.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- J. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify DEDC, LLC of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Arrow-Hart, a brand of Cooper Wiring Devices: www.cooperindustries.com
- B. Leviton Manufacturing, Inc: www.leviton.com.
- C. P & SNone - N/A.
- D. Bryant
- E. Hubbell

2.2 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.
- I. For flush floor service fittings, use tile rings for installations in tile floors.
- J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.3 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with None - N/A stainless steel wall plate.
- C. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.
- D. Wiring Devices Connected to Emergency Power: Red with red metal faceplate.

2.4 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes: As coordinated with architect.

2.5 WALL SWITCHES

- A. Wall Switches: Extra Heavy Duty Industrial Series, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: Gray plastic with toggle handle.
 - 2. Ratings:

- a. Voltage: 120 volts, AC.
- b. Current: 20 amperes.
- B. Switch Types: Single pole, 3-way, and 4-way.

2.6 RECEPTACLES

A. Manufacturers:

- 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
- 2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
- 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
- 4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
- 5. Substitutions: See Section 01 6000 - Product Requirements.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.

- 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
- 2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

- 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

- 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
- 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
- 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. Receptacles: Extra Heavy Duty Industrial Series, complying with NEMA WD 6 and WD 1.

1. Device Body: _____plastic.
2. Configuration: NEMA WD 6, type as specified and indicated.

G. Convenience Receptacles: Type 5-20R.

H. Single Convenience Receptacles.

I. Duplex Convenience Receptacles.

J. GFCI Receptacles: 5-20R Duplex Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.7 WALL PLATES

A. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

D. Decorative Cover Plates: , Smooth stainless steel.

E. Surface Mounted Device Wall Plates: Stamped steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1, including mounting heights specified in that standard unless otherwise indicated.
- C. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: As indicated on the drawings.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify DEDC, LLC to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

- D. Install wiring devices in accordance with manufacturer's instructions.
- E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- L. Install wall switches with OFF position down.
- M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- Q. Identify wiring devices in accordance with Section 26 0553.
- R. Connect wiring device grounding terminal to outlet box with bonding jumper.
- S. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- T. Connect wiring devices by wrapping conductor around screw terminal.
- U. Install galvanized steel cover plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted switches & outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 0537 to obtain mounting heights specified.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter.
- E. Install telephone jack 18 inches above finished floor.
- F. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches above finished floor.
- G. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Operate each wall switch with circuit energized and verify proper operation.
- E. Test each receptacle to verify operation and proper polarity.
- F. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fuses.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Fuse Pullers: One set(s) compatible with each type and size installed.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.

- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Power Load Feeder Switches: Class RK1 (time delay).
- H. Motor Load Feeder Switches: Class RK1 (time delay).

2.3 CLASS RK1 (TIME DELAY) FUSES

- A. Manufacturers:
 - 1. Bussman, Ferraz-Shawmut.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 2813

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Enclosed safety switches.
- B. Fusible switches.
- C. Nonfusible switches.

1.2 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2813 - Fuses.
- F. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- C. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- D. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Eaton Corporation; _____: www.eaton.com/#sle.
- B. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.
- C. Siemens: www.sea.siemens.com.
- D. Substitutions: See Section 01 6000 - Product Requirements.
- E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 0548 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- E. Horsepower Rating: Suitable for connected load.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
- K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- M. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- O. Heavy Duty Switches:
 - 1. Comply with NEMA BS 31047.
 - 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - a. Provide means for locking handle in the ON position where indicated.

2.3 COMPONENTS

- A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 2. Handle lockable in OFF position.
 3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses. Provide rejection clips to reject all other than Class R fuses.
 4. Fuse extenders where indicated on contract drawings.
- B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 2. Handle lockable in OFF position.
 3. Electrical interlocks, break before switch opens and close after switch closes, where indicated on contract drawings.
- C. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
 2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Provide required seismic controls in accordance with Section 26 0548.

- F. Install enclosed switches plumb.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Identify enclosed switches in accordance with Section 26 0553.
- L. Provide identification nameplate for each enclosed switch in accordance with Section 26 0553.
- M. Provide arc flash warning labels in accordance with NFPA 70.
- N. Install fuses in fusible disconnect switches.
- O. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2816.16

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
 - 1. Manual motor starters.
 - 2. Motor-starting switches without overload protection.
- B. Overcurrent protective devices for motor controllers, including overload relays.
- C. Control accessories:
 - 1. Auxiliary contacts.
 - 2. Pilot devices.
 - 3. Control and timing relays.
 - 4. Control power transformers.

1.2 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
 - 1. Includes requirements for the seismic qualification of equipment specified in this section.

1.3 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).
- E. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
- F. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- J. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
 - 3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
 - 4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 6. Notify DEDC, LLC of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Identify mounting conditions required for equipment seismic qualification.

- D. Manufacturer's equipment seismic qualification certification.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. ABB/GE; _____: www.geindustrial.com/#sle.
- B. Eaton Corporation; _____: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.
- D. Substitutions: See Section 01 6000 - Product Requirements.
- E. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.2 ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

- D. Seismic Qualification: Provide controllers and associated components suitable for application under the seismic design criteria specified in Section 26 0548 where required. Include certification of compliance with submittals.
- E. Service Conditions:
 - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
 - b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
 - 2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- F. Short Circuit Current Rating:
 - 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures:
 - 1. Comply with NEMA IA 10030.
 - 2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - b. Outdoor Locations: Type 3R or Type 4.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- I. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.

4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

J. Manual Motor Starters:

1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
 - a. Furnish with toggle operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 - c. Provide means for locking operator in the OFF position.
 - d. Furnish Red ON indicating light where not within sight of equipment.
4. Integral-Horsepower Manual Motor Starters:
 - a. Furnish with toggle or pushbutton operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 - c. Provide means for locking operator in the OFF position.
 - d. Furnish Red ON indicating light where not within sight of equipment.
 - e. Provide auxiliary contact where indicated; normally open (NO) or normally closed (NC) as indicated or as required.

- K. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Trip-free operation.
4. Visible trip indication.
5. Resettable.

- a. Employ manual reset unless otherwise indicated.
- b. Do not employ automatic reset with two-wire control.
- 6. Bimetallic Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
- 7. Melting Alloy Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.

2.4 CONTROL ACCESSORIES

A. Auxiliary Contacts:

- 1. Comply with NEMA IA 10039.
- 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:

- 1. Comply with NEMA IA 10039; heavy-duty type.
- 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
- 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
- 4. Indicating Lights: Push-to-test type unless otherwise indicated.
- 5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:

- 1. Comply with NEMA IA 10039.
- 2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
2. Include primary and secondary fuses.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Install all field-installed devices, components, and accessories.
- H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- I. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- J. Set field-adjustable circuit breaker tripping function settings as indicated.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- D. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.7 PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION 26 2913

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.
- E. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.
- B. Section 26 0533.16 - Boxes for Electrical Systems.
- C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015, with Errata (2017).
- C. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify DEDC, LLC of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Conform to requirements of NFPA 70 and NFPA 101.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all LED luminaires, including drivers.
- C. Provide five year manufacturer warranty minimum for all dimming drivers.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
 - 1. LED Tape - General Requirements:
 - a. Listed.
 - b. Designed for field cutting in accordance with listing.

2.3 DRIVERS

- A. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.4 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Airplane cable: Steel Wire.
- C. Fire-Rated Luminaire Enclosures:
 - 1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Provide required seismic controls in accordance with Section 26 0548.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- H. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 3. Install canopies tight to mounting surface.
 4. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- K. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- L. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- M. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- N. Install accessories furnished with each luminaire.
- O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.
- P. Connect luminaires to branch circuit outlets provided under Section 26 0537 using flexible conduit.
- Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

- R. Bond products and metal accessories to branch circuit equipment grounding conductor.
- S. Install specified lamps in each luminaire.
- T. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Perform field inspection in accordance with Section 01 4000.
- D. Operate each luminaire after installation and connection to verify proper operation.
- E. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
- F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by DEDC, LLC.

3.5 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by DEDC, LLC. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by DEDC, LLC or authority having jurisdiction.
- C. Aim and adjust fixtures as directed.

3.6 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean finishes and touch up damage.

3.7 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.9 PROTECTION

- A. Replace luminaires that have failed lamps or drivers at Substantial Completion.

3.10 SCHEDULE - SEE DRAWINGS

END OF SECTION 26 5100

SECTION 27 1000 - DATA & VOICE COMMUNICATIONS CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Data & Voice Communications Cabling Standards
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 16 Electrical Materials and Methods sections.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
 - 1. Cable
 - 2. Data & Voice jacks and faceplates

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store and handle cable and hardware to prevent damage during construction.
- B. Store and handle device boxes and conduit to prevent damage during construction.

PART 2 PRODUCTS & MANUFACTURERS

2.1 AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, THE FOLLOWING PRODUCTS MAY BE INCORPORATED IN THE WORK:

2.2 PLENUM CATEGORY 6 CABLE

- A. 23 AWG, 4 pair, White for Voice & Data
 - 1. Commscope Part # 7504 (1000 ft. reel)
 - 2. Commscope Part # 7504 (1000 ft. tote box)

3. HITACHI Part # 30183-8 (1000 ft. reel)
4. HITACHI Part # 30183-8 (1000 ft. tote box)
5. Hubbell Part # C6SPW (1000 ft. reel)
6. Hubbell Part # C6RPW (1000 ft. tote box)

2.3 CATEGORY 6 DATA & VOICE JACKS

- A. Hubbell Part #HXJ6EI
 1. T568B, Electrical Ivory
- B. Or approved Equal

2.4 FACEPLATES FOR DATA & VOICE

- A. Hubbell Part # IFP14EI (4 Port Plate)
 1. IFP PLATES SINGLE-GANG Electrical Ivory
- B. Or approved Equal
- C. Hubbell Part # P630SR1GC6
 1. Recessed 8-position Category 6, gray jack, RJ45
 2. Only for wall phones
- D. Or approved Equal

2.5 BLANK DUST COVERS FOR FACEPLATES

- A. Hubbell Part # SFBE10
- B. Or approved Equal

2.6 BLANK DUST COVERS FOR DATA & VOICE JACKS

- A. Hubbell Part # HXJDC25
- B. Or approved Equal

2.7 TERMINATION TOOLS

- A. Punch Down Tool with 110 Blade, BIX Blade & 66 Blade.
 1. When terminating on the new Hubbell CAT 6 jacks for both DATA & VOICE, the tools of choice is:
PUNCH-DOWN TOOL,(1-PUNCH) Part number - HUBBELL TX4P.

2. Or approved Equal

2.8 TERMINATION TOOLS

A. Punch Down Tool with 110 Blade, BIX Blade & 66 Blade.

1. When terminating on the new Hubbell CAT 6 jacks for both DATA & VOICE, the tools of choice is:
PUNCH-DOWN TOOL,(1-PUNCH) Part number - HUBBELL TX4P.
2. Or approved Equal

2.9 WALL/FLOOR/DECKING PENETRATION FIRE RATED PATHWAY (EZ-PATH)

A. Single Series 44 Pathway Through Finished Walls

1. Part Number EZDP44
 - a. Single Wall Plate Kit is designed to allow a single Series 44 Pathway to be installed in a 6 in. (152 mm) round opening or 4-1/8 in (105 mm) x 4-5/8 in (118 mm) opening.
2. Or approved Equal

B. Single Series 44 Pathway Through Floors

1. Part Number EZDP144FK
 - a. Circular Wall Plate Kits allow a single Series 33 Pathway to be installed in a 4 in. (102 mm) round opening or 3 in. (76 mm) x 3 in. (76 mm) square opening.
2. Part Number EZDP133CWK
 - a. The Split Floor Plate Kit is designed to allow a single Series 44 Pathway to be installed in a 6 in. (152 mm) round opening or 4-1/8 in. (105 mm) x 4-5/8 in. (118 mm) opening. Split plate is designed to permit use with previously installed cables.
3. Or approved Equal

C. Multiple or Ganged Pathway Installations

1. Part Number EZP544W
 - a. Multi-Gang Wall Brackets are designed to allow 1 to 5 Series 44 Pathways to be installed in finished walls or as the wall is being built. Plates attach directly to studs and pathways are installed prior to application of gypsum board. Brackets are suitable for attachment to studs spaced up to 24 in. (610 mm). Single Wall Plate Kit is designed to allow a single Series 44 Pathway to be installed in a 6 in. (152 mm) round opening or 4-1/8 in (105 mm) x 4-5/8 in (118 mm) opening.

2. Or approved Equal
- D. Series 44 Pathways Modular Floor Grid Systems utilize the high volume
 1. Part Number EZDG444 Capacity: 4 Pathways
 - a. Sold complete with grid and pathways.
 - b. Multi-Gang Wall Brackets are designed to allow 1 to 5 Series 44 Pathways to be installed in finished walls or as the wall is being built. Plates attach directly to studs and pathways are installed prior to application of gypsum board. Brackets are suitable for attachment to studs spaced up to 24 in. (610 mm). Single Wall Plate Kit is designed to allow a single Series 44 Pathway to be installed in a 6 in. (152 mm) round opening or 4-1/8 in. (105 mm) x 4-5/8 (118 mm) opening.
 2. Or approved Equal
- E. NOTE: Ordering Details
 1. • Plate packs include plates, gaskets, set screws and labels.
 2. • Purchase Pathways (EZD44) and appropriate fasteners separately.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to starting work, examine condition of site and existing hardware already in place with Owner's Representative present. Check all existing lines and levels indicated. Report any discrepancies with the construction documents, in writing, to the Owner's Representative.

3.2 CONTRACTOR QUALIFICATIONS AND TRAINING

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
 1. Possess those licenses/permits required to perform both Data & Telecommunications installations in the specified jurisdiction.
 2. Provide references of the type of installation provide in this specification.
 3. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
 4. Be in business a minimum of five (5) years.

5. Must possess current liability insurance certificates.

3.3 INSTALLATION OF WALL/FLOOR/DECKING PENETRATION

- A. Contractor shall provide and install approved Penetration Firestop Sleeve System. All data, video, and communications cable bundles shall utilize an enclosed fire rated pathway device wherever said cables penetrate rated walls. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to adjust, remove or reinstall firestop materials.

3.4 INSTALLATION OF CABLING

- A. Contractor shall provide and install data & voice cables from device jack to specified data termination closet, where end will be rolled up for future termination by the City. Contractor shall terminate cables at wiring device end and clearly label both ends with Owner's numbering system.
- B. Materials to be furnished may be subject to inspection at the factory, in the warehouse or in the field by the Owner's Representative or by qualified inspectors retained by the Owner's Representative.
- C. Install all elements of the data & voice communications system in accordance with Division 16 Basic Materials and Methods Sections.
- D. All Category 6 data wiring to be installed in accordance with IEEE/EIA/TIA 802.3 standards for 100 BASE-TX.
- E. All Category 6 voice wiring will be installed in accordance with Telephone and Communications Industry Standards.
- F. All UTP and fiber optic cables shall conform to ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard (latest amendment and including all applicable addenda) and ISO/IEC 11801 (International) Generic Cabling for Customer Premises standard (latest amendment and including all applicable addenda).
- G. All communications wiring shall be installed in a 4" square 2 1/8" deep back box with a single gang tile ring, with a 1" conduit stubbed above the ceiling, not to exceed four per conduit and four jacks per box. Any additional wiring shall require additional conduit and back boxes. Again not to exceed four wires per conduit and per back box.

3.5 LABELING FOR DATA

- A. Each new wire should be labeled as follows; closet # - patch panel letter - port # (Example: 6131-A-001). Labels shall be located 1/4"-1" from both ends of each wire. The jack faceplate of each new wire shall be similarly labeled. The contractor shall also label the front of each patch panel port with a P-TOUCH label showing the room number of the corresponding jack. The Owner's Representative will provide the closet number, patch panel letter(s) and available patch panel port numbers.

3.6 LABELING FOR VOICE

- A. Device outlets (FACEPLATES) are to be labeled with the closet number and followed by a hyphen then letter "V" followed by cable number. (Example:L106-V001, 2, 3, etc.)
- B. Terminal BIX blocks in the closet are to be labeled with room number and followed by hyphen then letter "V" followed by cable number. (Example:L856-V001, 2, 3, etc.)
- C. Wire labels shall be located 1/4"-1" from both ends of the cable with the closet number and cable number (Example:L106-V001).
 - 1. (Example:L106-V001)

3.7 TESTING FOR DATA

- A. Each installed twisted pair cable shall be tested, using a Fluke/Microtest DPS-4300 series or OMNIScanner2. When running the AUTO TEST feature the following test will executed, Length, Attenuation, Near End Crosstalk (NEXT) Loss, Power Sum Near-End Crosstalk (PSNEXT) Loss, Equal Level Far-End Crosstalk (ELFEXT),Power Sum Equal Level Far-End Crosstalk (PSELFEXT), Return Loss, Propagation Delay (ANSI/TIA/EIA-568-B-1), Longitudinal Conversion Loss (LCL), Attenuation to Crosstalk Ratio (ACR), Power Sum Attenuation to Crosstalk Ratio (PSACR) from both ends. Each circuit number will be identified using the same labeling scheme as required on the jack faceplate. Test results will be provided to the Owners Representative in both hard copy and soft copy on CD as specified in the Reports section. The Contractor may propose an equivalent testing method by submitting full documentation thereof for review by the Owner's Representative.
- B. All Category 6 channels are qualified for linear transmission performance up to 300 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
- C. All UTP field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
- D. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
- E. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.8 TESTING FOR VOICE

- A. Testing for voice wires will consist of wire map and continuity.

3.9 JACK TERMINATIONS

- A. Hubbell quad wall jack plate shall be used whenever a new wire for data & voice jacks are required, unless specified otherwise. If there is an existing data & voice jack within two feet of the new jack location, the existing data & voice jack shall be upgraded to a Hubbell quad wall jack.
- B. Sockets 1 and 2, in that order, will normally be occupied by voice (telephone) connections. Sockets 4 and 3, in that order, will normally be the data positions on the quad jack. If 6 port single gang plate is required data will start in position 6 and work backwards. If there is no need for voice connections, positions 2 and 1, in that order, may be used for data jacks but only at the discretion of the Owner's Representative.
- C. Data Termination
 - 1. Use RJ45-TIA/EIA-568-B Configurations
 - 2. NO SPLITTING OF PAIRS, one jack equals one cable
- D. Voice Termination
 - 1. Use RJ45-TIA/EIA-568-B Configurations
 - 2. NO SPLITTING OF PAIRS, one jack equals one cable

PART 4 ADMINISTRATION DOCUMENTATION

4.1 DRAWINGS

- A. As-built drawing shall be supplied by the contractor showing the locations of and identifiers for all:
 - 1. Horizontal cable routing and terminations
 - 2. Telecommunications outlets/connectors
 - 3. Backbone cable routing and terminations

4.2 REPORTS

- A. All wires installed in the project shall be tested and documented with the completed documentation being turned over to the Owners Representative with all As Built Documentation.

4.3 DATA TEST RESULTS

- A. Each data wire will be tested as specified in Section 3.6. Each record must contain the identifier as specified in Labeling Section.3.4. Final results will be provided in both hard copy and soft copy format, preferably CD.

4.4 VOICE TEST RESULTS

- A. Each voice wire will be tested as specified in Section 3.7. Each record must contain the identifier as specified in Labeling Section 3.5. The final voice report shall be in hard copy and soft copy format preferably CD.

END OF SECTION 27 1000

SECTION 28 4600 - FIRE DETECTION AND ALARM

SPECIFYING STRATEGY

- 1.1 STEP 1: REVIEW "FIRE ALARM SYSTEM" ARTICLE UNDER PART 2.
 - 1.2 STEP 2: REVIEW PRODUCT ARTICLES UNDER PART 2.
 - A. Links for some products should already be activated according to selections made in "FIRE ALARM SYSTEM" article.
 - 1.3 STEP 3: REVIEW PART 3.
 - 1.4 STEP 4: REVIEW PART 1.
 - A. Pay particularly close attention to "RELATED REQUIREMENTS" article for interface requirements that might need to be specified elsewhere.
-

PART 1 GENERAL

- 3.1 SECTION INCLUDES
 - A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.
 - B. System Carbon Monoxide Detectors.
 - C. System Combination Smoke/Carbon Monoxide Detectors.
- 3.2 RELATED REQUIREMENTS
 - A. Section 07 8400 - Firestopping.
 - B. Section 08 7100 - Door Hardware:
 - C. Section 21 1300 - Fire-Suppression Sprinkler Systems: For interface with fire alarm system.
 - D. Section 23 3300 - Air Duct Accessories: Smoke/fire dampers for interface with fire alarm system.
 - E. Section 26 0533.16 - Boxes for Electrical Systems.
 - F. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems: Requirements for seismic qualification of equipment specified in this section.

3.3 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

3.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Drawings must be prepared using AutoCAD Release 2015 or higher.
 - 1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.
- C. Evidence of designer qualifications.
- D. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.
- E. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.
 - 1. Copy (if any) of list of data required by AHJ.
 - 2. NFPA 72 "Record of Completion", filled out to extent known at time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.

4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
 5. Certification by manufacturer of FACU that system design complies with Contract Documents.
 6. Certification by Contractor that system design complies with Contract Documents.
- F. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.
1. System zone boundaries and interfaces to fire safety systems.
 2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
 3. Include elevations and details of proposed equipment arrangements.
 4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
 5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
 6. Include requirements and control diagrams for interfacing with other systems.
 7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
 8. List of devices and notification appliances on each SLC, with spare capacity indicated.
 9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 11. Detailed drawing of graphic annunciators, displays, and interfaces.
 12. Certification by either FACU manufacturer or manufacturer of related equipment.
 13. Certification by FACU manufacturer that system design complies with Contract Documents.
 14. Certification by Contractor that system design complies with Contract Documents.

- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Manufacturer's equipment seismic qualification certification.
- I. Evidence of installer qualifications.
- J. Evidence of maintenance contractor qualifications, if different from installer.
- K. Inspection and Test Reports:
 - 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.
 - 3. Submit NFPA 72 "Inspection and Test," filled out.
- L. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
 - 1. Complete set of specified design documents, as approved by AHJ.
 - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 - 4. List of recommended spare parts, tools, and instruments for testing.
 - 5. Replacement parts list with current prices, and source of supply.
 - 6. Detailed troubleshooting guide and large scale input/output matrix.
 - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 - 8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.
- M. Project Record Documents: See Section 01 7800 for additional requirements, have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.

3. "As programmed" operating sequences, including control events by device, and updated input/output chart.

N. Closeout Documents:

1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.
3. Certificate of Occupancy.
4. Maintenance contract.

O. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
2. In addition to items in quantities indicated in PART 2, furnish the following:
 - a. Tools, software, and documentation necessary to modify fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, notification appliances, circuits, and zones, and changes to system description, and operation.
 - b. One copy of software not resident in read-only-memory.
 - c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

3.5 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.
- B. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
 1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least two years of experience installing fire alarm systems.

3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.
 4. Contract maintenance office located within 50 miles of project site.
 5. Certified in Pennsylvania as fire alarm installer.
- C. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.
- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

3.6 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

4.1 FIRE ALARM SYSTEM

- A. General Requirements:
1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
 2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. 36 CFR 1191 and ADA Standards.
 - b. Requirements of AHJ.
 - c. Applicable local codes.
 - d. Contract Documents.
 - e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
 3. Fire Alarm System Products:
 - a. Listed, classified, and labeled as suitable for purpose intended.
 - b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.

4. Provide fire alarm circuits in accordance with NFPA 70.
 - a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
 - b. Power Sources:
 - 1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
 - 2) Primary: Dedicated branch circuits from facility power distribution system.
 - 3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
 - c. Wiring and Wiring Methods:
 - 1) General Requirements:
 - (a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
 - (b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
 - (c) Special Occupancies: Comply with NFPA 70.
 - (d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
 - 2) Fire Alarm Circuits:
 - (a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
 - (b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
 - (1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
 - (c) Power-Limited Fire Alarm (PLFA) Circuits:
 - (1) Provide identification for PLFA circuits in accordance with NFPA 70.
5. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
 - a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.

b. Pathway Class Designations:

- 1) Unless otherwise indicated or required, pathways to meet the following requirements:
 - (a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
 - (b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
 - (c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

B. Fire Alarm System Interfaces and Control Functions:

1. UL 864 listed unless otherwise indicated.
2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.

4.2 MANUFACTURERS

A. Fire Alarm Control Units: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:

1. Honeywell Security & Fire Solutions/Silent Knight; 6820: www.silentknight.com/#sle.

B. Initiating Devices and Notification Appliances:

1. Provide initiating devices and notification appliances made by the same fire alarm control panel manufacturer, where possible.

4.3 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.

- c. The requirements of the local authority having jurisdiction .
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
- 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises. Sleeping areas shall be provided with 520MHz Low Frequency Square wave type speaker/strobes.
- 5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
- 6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
- 7. Master Control Unit (Panel): New, located at location as shown on plans.
- B. Supervising Stations and Fire Department Connections:
 - 1. Means of Transmission to Remote Supervising Station: Digital Alarm Communication Transmitter with VOIP (IP-DACT).
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 - 3. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
 - 4. Notification Appliance Circuits (NAC): Class B, Style Y.
- D. Spare Capacity:
 - 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 - 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 - 3. Speaker Amplifiers: Minimum 25 percent spare capacity.

4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

- F. Seismic Qualification: Provide fire alarm system and associated components suitable for application under the seismic design criteria specified in Section 26 0548 where required. Include certification of compliance with submittals.

4.4 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.
2. Sprinkler room low temperature
3. Elevator shut-down control circuits.

- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.
2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment upon activation of fire alarm system.
3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
4. Duct smoke detectors.
5. Carbon Monoxide detectors.
6. Combination Smoke/ Carbon Monoxide detectors.
7. All initiating devices.

- C. Trouble: Provide trouble signals in accordance with NFPA 72 for the following:

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.

D. Elevators:

1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

E. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

F. Doors:

1. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

4.5 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

- D. Remote Annunciators: _____.
- E. Initiating Devices:
 - 1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
 - 2. Manual Pull Stations: Double-action.
 - a. Provide 1 extra.
 - 3. Smoke Detectors: Photoelectric.
 - a. Provide 1 extra.
 - 4. Duct Smoke Detectors: Photoelectric. Provide with remote test and indicating lamp.
 - a. Provide 1 extra.
 - 5. Carbon Monoxide Detectors:
 - a. Provide 1 extra.
 - 6. Combination Smoke/ Carbon Monoxide Detectors:
 - a. Provide 1 extra.
 - 7. Heat Detectors: _____.
 - a. Provide 1 extra.
 - 8. Addressable Interface Devices: Provide monitor modules and control relays as required..
 - a. Provide 1 extra.
- F. Notification Appliances:
 - 1. Horns _____.
 - a. Provide 1 extra.
 - 2. Horn/Strobes.
 - a. Provide 1 extra.

3. 520MHz Low Frequency Horn/Strobes
4. Strobes: _____.
 - a. Provide 1 extra.
- G. Circuit Conductors: Copper; provide 200 feet extra; color code and label.
- H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
 1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
 2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
 3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- I. Locks and Keys: Deliver keys to Owner.
 1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 2. Provide one for each control unit where operations are to be performed.
 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 4. Provide extra copy with operation and maintenance data submittal.
- K. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
 1. Padlock eye and hasp for lock furnished by Owner.
 2. Locate as directed by Owner.

PART 3 EXECUTION

5.1 INSTALLATION

- A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:
- B. Field Locations:
 - 1. Obtain Owner's approval of locations of devices and notification appliances before installation.
 - 2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
 - 3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.
- C. Raceways and Supports:
 - 1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
 - 2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
 - 3. Install firestopping to preserve fire resistance rating of partitions and other elements.
- D. Wiring and Connections:
 - 1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
 - 2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
 - 3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
 - 4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
 - 5. Provide grounding and bonding in accordance with Section 26 0526.
 - 6. Comply with manufacturer's minimum cable sizes or ratings.

7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
 8. Provide network wiring in accordance with NFPA 70.
 9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
 10. See manufacturer's instructions for batteries.
- E. Fire Alarm System Components:
1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
 - a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
 2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
 3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.
- F. Branch Power:
1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
 2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
 3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.
- G. System Identification:
1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 26 0553.
 2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
 3. Mark location of disconnecting means for NPFLA circuits.
 4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.

5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:

1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:

1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

5.2 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.
- E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.
- G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.
 1. Record system operations and malfunctions.
 2. If malfunction occurs, start diagnostic period over after correction of malfunction.
 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

5.3 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
- B. Administrative: One-hour session(s) covering issues necessary for nontechnical administrative staff; classroom:
 - 1. Initial Training: One session precloseout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: One session precloseout.
- D. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

5.4 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals for additional submittals.
- B. See Section 01 7900 - Demonstration and Training for additional requirements.
- C. Closeout Demonstration: Demonstrate operation of all functions to Owner.
 - 1. Be prepared to conduct any of required tests.
 - 2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of FACU manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
 - 5. Repeat demonstration until successful.
- D. Occupancy will not occur prior to Substantial Completion.
- E. Substantial Completion of project cannot be achieved until inspection and testing is successful and the following:
 - 1. Specified diagnostic period without malfunction has been completed.
 - 2. Approved operating and maintenance data has been delivered.
 - 3. Spare parts, extra materials, and tools have been delivered.

4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of fire alarm system has been given by AHJ.
6. Occupancy permit has been granted.
7. Specified precloseout instruction is complete.

5.5 MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.
- B. Provide to Owner as alternate to base bid separate maintenance contract for service and maintenance of fire alarm system for entire warranty period to include work described below; include complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with detailed schedule.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.
 3. Record keeping required by NFPA 72 and AHJ.
- D. Provide trouble call-back service upon notification by Owner:
 1. Provide on-site response within two hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.
- F. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 4600

SECTION 31 2316.13 - TRENCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Unit Price ____: Excavating Soil Materials:

1. Measurement method: By the cubic foot.
2. Includes: Excavating to required elevations, loading and placing materials in stockpile, and dewatering.
3. Does Not Include Over-Excavation: Payment will not be made for over-excavated work nor for replacement materials.

- B. General Fill:

1. Measurement Method: By the cubic foot.
2. Includes: Excavating existing soil, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.

- C. Granular Fill:

1. Measurement Method: By the cubic foot.
2. Includes: Excavating existing material, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.

- D. Aggregates:

1. Measurement Method: By the cubic foot.
2. Includes: Excavating existing material, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.

1.3 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.

1.4 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop; 2018.

- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012, with Editorial Revision (2015).
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- C. Compaction Density Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General Fill: Conforming to State of Maryland Highway Department standard.

2.2 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities.
- D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect plants, lawns, rock outcroppings, and other features to remain.
- F. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the DEDC, LLC.

3.3 TRENCHING

- A. Notify DEDC, LLC of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Remove excess excavated material from site.
- I. Provide temporary means and methods, as required, to remove all water from trenching until directed by the DEDC, LLC. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- J. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the DEDC, LLC.

3.4 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.5 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- F. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- G. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- H. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. At other locations: 95 percent of maximum dry density.
- I. Reshape and re-compact fills subjected to vehicular traffic.

3.6 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, Duct Bank, and _____ and _____:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

3.7 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

TRENCHING

3.8 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.9 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION 31 2316.13