Proposed

Bedford Fire Headquarters

550 Old Post Road, Bedford New York 10506

Project Manual & Specifications

January 15, 2020

Owner
Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Landscape Architect
IQ Landscape Architects, P.C.
31 Mamaroneck Avenue
White Plains, New York 10601
914-232-0200

Architect
Sullivan Architecture, P.C.
31 Mamaroneck Avenue
White Plains, NY 10601
914-761-6006

Structural Engineer
Conlon Engineering, LLC
246 Federal Road, Suite B23
Brookfield, CT 06804
203-740-0990

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500 Main Street
Armonk, NY 10549
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MEP Engineer
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SECTION 00 11 13 - ADVERTISEMENT FOR BIDS

Notice is hereby given that **SEALED PROPOSALS** for:

BEDFORD FIRE HEADQUARTERS
550 OLD POST ROAD
BEDFORD, NY 10506

CONTRACT #1 – SITE WORK CONTRACT
CONTRACT #2 – GENERAL WORK CONTRACT
CONTRACT #3 – MECHANICAL WORK CONTRACT
CONTRACT #4 – ELECTRICAL WORK CONTRACT
CONTRACT #5 –PLUMBING WORK CONTRACT
CONTRACT #6 – FIRE PROTECTION WORK CONTRACT

will be received until **2:00 PM** on **Tuesday, March 30, 2021** at the **Offices of the Bedford Village Fire District**, located at **34 Village Green, Bedford, New York, 10506,** where the bids will be publicly opened and read aloud. **The bid opening will be livestreamed** and accessible for public viewing. **Interested parties MUST request an invitation to the livestream** no later than noon on the day of the bid opening. Requests must be emailed to bids@arriscontracting.com; requesters must include their name, the name of the firm being represented and a valid email address where the invitation should be sent to. For precautionary reasons, bidders and other members of the public will not be admitted to the physical bid opening. In the event that on this date the Bedford Village Fire District is closed or due to weather or any other emergency, bids will be due at 2:00 p.m. on the next day that the District is open.

Complete digital sets of Bidding Documents, including Drawings and Specifications, may be obtained online as a download for **Forty Nine Dollars and 00 cents ($49.00)** at the following website: **www.usinglesspaper.com** under 'public projects' beginning on Monday **, March 01, 2021.**

Complete sets of Bidding Documents, including Drawings and Specifications, may be obtained from Rev, 330 Route 17A, Suite #2, Goshen, New York 10924 Tel: 1-877-272-0216, upon depositing the sum of **One Hundred Dollars and 00 cents ($100.00)** for each combined set of documents. Checks or money orders shall be made payable to **BEDFORD VILLAGE FIRE DISTRICT**. Hardcopy plan deposits are refundable in accordance with the terms in the Instructions to Bidders to all submitting bids. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

All bid addenda will be transmitted to registered plan holders via email and will be available at **www.usinglesspaper.com**. Plan holders who have paid for hard copies of the Bidding Documents will need to make the determination if hard copies of the addenda are required for their use, and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

Bids must be made in the standard proposal form in the manner designated therein and as required by the specifications that must be enclosed in sealed envelopes bearing the name of the job and name and address of the bidder on the outside, addressed to: **"BEDFORD VILLAGE FIRE DISTRICT,"** with contract number, and bidder name and bid opening date, clearly marked on the outside. The Bedford Village Fire District is not responsible for bids opened prior to the bid opening if bid contract number and opening date do not appear on the envelope. Bids opened prior to date and time indicated are invalid. The bidder assumes the risk of any delay in the mail, or in the handling of the mail by employees of the Bedford Village Fire District, as well as improper hand delivery.

Each proposal submitted must be accompanied by a certified check or bid bond, made payable to the **"BEDFORD VILLAGE FIRE DISTRICT,"** in an amount equal to FIVE percent (5 %) of the total amount of the bid, as a commitment by the bidder that, if its bid is accepted, it will enter into a contract to perform the work and will execute such further security as may be required for the faithful performance of the contract.

Each bidder shall prepare his/her bid proposal, along with the bid security, in accordance with the terms and subject to the conditions set forth in the Instructions to Bidders. Attention of the bidders is called to the requirements as to the conditions of employment and minimum wages to be paid under the contracts. **Certification of bonding company is required for this bid, see Instruction to Bidders section.**

Each bidder shall agree to hold his/her bid price for forty-five (45) days after the formal bid opening.

A pre-bid meeting will be held virtually and is scheduled for 10:00 AM on Tuesday, March 16, 2021. Although the pre-bid meeting is **not** mandatory, it is highly recommended that all potential bidders attend. **Pre-bid site visits will be held on March 17th 2021** and are to be scheduled in advance with Frank Roberts of ACCI (914) 755-0930. Visit times will be scheduled in small groups, starting at 10:00 am in order to allow social distancing. Proper personal protective equipment to access public spaces should be utilized when attending a pre-bid site visit.

It is the Bedford Village Fire District's intention to award the contract to the lowest responsive and responsible bidder providing the required security who meets the experience, technical and budget requirements. The Bedford Village Fire District reserves the right to reject any or all bids, waive any informality and to accept such bid which, in the opinion of the Bedford Village Fire District, is in the best interests of the Bedford Village Fire District. The form of contract is included with the Bidding Documents.

By Order of the Fire District Commissioners

Bedford Village Fire District
34 Village Green
Bedford, New York 10506

AIA® Document A701™ – 2018

Instructions to Bidders

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

Bedford Fire Headquarters
550 Old Post Road
Bedford, NY 10506

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

Bedford Village Fire District
34 Village Green
Bedford, NY 10506

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

Architectural and Structural Engineering:
PC Studio Architect, PLLC
1511 Route 22, Suite C-23
Brewster, NY 10509

Civil Engineering:
Kellard Sessions
500 Main Street
Armonk, NY 10504

Mechanical and Electrical Engineering:
OLA Consulting Engineers
50 Broadway
Hawthorne, NY 10532

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5 CONSIDERATION OF BIDS

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7 PERFORMANCE BOND AND PAYMENT BOND

8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

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

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

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

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

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ARTICLE 1 DEFINITIONS

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

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

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

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents. Wherever the word "Bid" occurs in the Bidding Documents, it refers to the Bidder's proposal.

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

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

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

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

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

§ 1.10 "Architect" shall mean, as appropriate to the context, the registered design professional, Architect or Engineer, preparing, in whole or in part, the Contract Documents, providing design and construction documentation, or providing Construction Administration Services for all or portions of this Project pursuant to an agreement with the Owner, and is referred to throughout the Contract Documents as if singular in number and masculine in gender. Where the term "Architect" is stated throughout the Contract Documents and herein, "Architect" shall refer to the Architect or Engineer, or possibly both, depending on the Architect's or Engineer's responsibility to the related item(s).

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** The Bidder has visited the site, examined the site and all existing facilities where the Project work is to be done, conducted all tests required to verify Owner-provided information, made all reviews of publicly available documents concerning the Work, reviewed the study results finding asbestos and lead on the Project site, reviewed all available as-built drawings, become familiar with local conditions under which the Work is to be performed, reviewed the Bidding Documents, the proposed Contract Documents, and all Addenda, and has correlated the Bidder's personal observations with the requirements of the foregoing. The Bidder shall inspect accessible concealed areas of existing construction, provided no significant permanent damage is inflicted upon the Owner's property. Lack of knowledge about conditions in accessible concealed areas shall not be a basis for additional cost claims at a later time. By submitting a Bid, the Bidder verifies that all Owner-provided information in the Bidding Documents and proposed

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Contract Documents is accurate and the Bidder waives any claim based on inaccuracy in the Bidding Documents or proposed Contract Documents that should have been reasonably found in a thorough inspection and testing of the Project site and review of the proposed Contract Documents and publicly available information;

.5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and

.6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor and the General Conditions of the Contract for Construction.

§ 2.2 It is understood and agreed that the Bidder has, by careful examination, satisfied itself as to the nature and location of the Work, and confirmation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under the proposed Contract Documents.

§ 2.3 No official, officer or agent of the Owner is authorized to make any representations as to the materials or workmanship involved or the conditions to be encountered and the Bidder agrees that no such statement or the evidence of any documents or plans, not a part of the Bidding Documents, shall constitute any grounds for claim as to conditions encountered. No verbal agreement or conversation with any officer, agent or employee of the Owner either before or after the execution of this Contract shall affect or modify any of the terms or obligations herein contained.

§ 2.4 The Bidder acknowledges its understanding and agreement that it has informed itself fully as to the conditions relating to construction and labor under which the Work will be performed and agrees as far as possible to employ such methods and means in the performance of its work so as not to cause interruption or interference with any other contractor.

§ 2.5 The Bidder's attention has been directed to the fact that all applicable state laws, municipal ordinances, and rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they are deemed to be included in the Contract Documents the same as though herein written out in full. By submitting a Bid, the Bidder acknowledges that if awarded the Contract it shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified in the Contract Documents. By submitting a Bid, the Bidder acknowledges that if awarded the Contract it shall be required to observe all laws and ordinances including, but not limited to, relating to the obstructing of streets, maintaining signals, keeping open passageways and protecting them where exposed to danger, and all general ordinances affecting it, its employees, or its work hereunder in its relations to the Owner or any person. By submitting a Bid, the Bidder acknowledges that if awarded the Contract it shall also obey all laws and ordinances controlling or limiting the Contractor while engaged in the prosecution of the Work under the Contract.

§ 2.6 The Bidder's attention has been directed to the fact that if the Contractor observes that the Drawings and Specifications are at variance with laws and regulations, it shall promptly notify the Architect in writing and any necessary changes shall be adjusted as provided in the Contract Documents for changes in the Work. By submitting a Bid, the Bidder acknowledges that if awarded the Contract and it performs any Work knowing it be contrary to such laws, ordinances, rules, regulations, or specifications, or local, state or federal authorities without such notice to the Architect, it shall bear all costs arising therefrom.

§ 2.7 The Bidder's attention is directed particularly to the Contract Documents provisions whereby the Contractor will be responsible for any loss or damage that may occur to the Work or any part thereof during its progress and whereby the Contractor must make good any defects or faults in the Work that may occur during the progress or within two (2) years after its acceptance. The Contractor shall provide for the continuation of the Performance Bond as a Maintenance Bond for two (2) full years after date of final payment request at the full Contract Sum. The Work is to be performed and completed to the satisfaction of the Owner & Architect and in accordance with the Specifications annexed hereto and the Drawings referred to therein.

§ 2.8 The Bidder's attention is directed to the fact that each Contractor shall pay not less than the minimum hourly wage rates on those contracts as established in accordance with Section 220 of the Labor Law as shown in the schedule included in the Bidding Documents. Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, provides (among other things) that it shall be the duty of the fiscal officer to make a determination of the schedule of wages to be paid to all laborers, workers and mechanics employed on public work projects, including supplements for

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welfare, pension, vacation and other benefits. These supplements include hospital, surgical or medical insurance, or benefits; life insurance or death benefits; accidental death or dismemberment insurance; and pension or retirement benefits. If the amount of supplements provided by the employer is less than the total supplements shown on the wage schedule, the difference shall be paid in cash to the employee. Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, also provides that the supplements to be provided to laborers, workers and mechanics upon public work, "... shall be in accordance with the prevailing practices in the locality..." The amount for supplements listed on the enclosed schedule does not necessarily include all types of prevailing supplements in the locality, and a future determination of the Industrial Commissioner may require the Contractor to provide additional supplements. The original payrolls or transcripts shall be preserved for three (3) years from the completion of the Work on the awarded project by the Contractor. The Owner shall receive such payroll record upon completion of the Project.

§ 2.9 To be considered qualified, the Bidder must demonstrate to the Owner's satisfaction the following:

- **.1** The corporation, partnership, sole proprietorship of other business entity in whose name the Bid is submitted has been in business, continuously, for no less than the previous five (5) years performing or coordinating the work which it is bidding on;
- **.2** The Bidder has satisfactorily completed no less than five (5) projects of comparable size, complexity and type to this Project as a prime contractor to project owner;
- **.3** The bidder is not currently involved in bankruptcy proceedings;
- **.4** The Bidder is licensed to perform the work it is bidding on in the jurisdiction where the work will take place;
- **.5** The Bidder is capable of and intends to perform at least 25% of the Work with its own forces;
- **.6** The Bidder is able to perform the Work with the manpower available to it; and
- **.7** The Bidder and its subcontractors have a minimum of five (5) years' experience in the Work and applicable trades.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

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

See Advertisement for Bids

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 It is the responsibility of the Bidder before submitting a Bid:

- **.1** To examine thoroughly the proposed Contract Documents and other related data identified in the Bidding Documents;
- **.2** To visit the site to become familiar with and satisfy Bidder as to the general, local and site conditions that may affect cost, progress, performance or furnishings of the Work;
- **.3** To consider federal, state and local laws and regulations that may affect cost, progress, performance or furnishing of the Work;
- **.4** To study and carefully correlate Bidder's knowledge and observations with the proposed Contract

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Documents and such other related data;

.5 To promptly notify the Architect, in writing, of all conflicts, errors, ambiguities or discrepancies that the Bidder has discovered in or between the proposed Contract Documents and such other related documents; and

.6 In the absence of an interpretation by the Architect, should the Drawings disagree in themselves or with the Specifications, the better quality, the more costly or the greater quantity of work or materials shall be estimated upon, and unless otherwise determined, shall be furnished.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven (7) days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

John Patrick Jackson, Project Manager
Email: jpjackson@arriscontracting.com
Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

With a copy to:
Sara Figueroa-Lobdell
Email: SFigueroa-Lobdell@arriscontracting.com
Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. All Addenda so issued shall become part of the Contract Documents. If any Addenda may materially affect the bid, as solely determined by the Owner, the Owner may extend the Bid date. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them. No oral interpretation will be made to any Bidder as to the meaning of the proposed Contract Documents or any part thereof. Every request for such an interpretation shall be made in writing to the Architect.

§ 3.3 Equivalents

§ 3.3.1 In the Specifications in the proposed Contract Documents, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Bidder may select one of these items or, if the Bidder desires to use any kind type, brand, or manufacturer or material other than those named in the specifications, it shall indicate in writing when requested, and prior to the submittal of Bids, what kind, type, brand or manufacturer is included in the Base Bid for the specified item.

§ 3.3.2 Equivalents Process

§ 3.3.2.1 Written requests for equivalents shall be received by the Architect at least ten (10) days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit equivalents requests on a Request for Equivalent Review Form if one is provided in the Bidding Documents.

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

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

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

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

§ 3.4 Addenda

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

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

All Bid Addenda will be transmitted to registered plan holders via email and will be available at www.usinglesspaper.com.

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

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

§ 3.4.4 Prior to submitting a Bid, the Bidder shall ascertain that the it has received all Addenda issued, and the Bidder shall acknowledge receipt in the Bid. It shall be the Bidder's responsibility to make inquiry as to the existence of Addenda issued. All such Addenda shall become part of the Contract Documents and the Bidder shall be bound by such Addenda whether or not received by the Bidder.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents. Failure to use said forms or the inclusion of bids not requested shall result in rejection of the Bid. The Project Manual shall not be submitted or included in the Bidder's Bid package. No Bid will be considered which does not include bids for all items listed in the proposal sheets.

§ 4.1.2 All blanks on the Bid Form shall be legibly executed. Bid Forms shall be executed in a non-erasable medium.

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

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

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

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

§ 4.1.7 The Bidder must state in the Bid his/her full name and business address, and the full name of every person, firm or corporation interested therein and the address of every person or firm, or president and secretary of every corporation interested with it; if no other person, firm or corporation be so interested, it must affirmatively state such fact. The Bidder must also state that the Bid is made without any connection (directly or indirectly) with any other bidder for the work mentioned in its Bid and is (in all respects) without fraud or collusion; it has inspected the site of the Work and has examined the Bidding Documents; no person acting for or employed by the Owner is directly or indirectly interested therein, or in the supplies or Work to which it relates or in any portion of the prospective profits thereof; it proposes and

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agrees if its Bid is accepted, to execute a contract with the Owner to perform the work mentioned in the proposed Contract Documents attached; and the amount it will accept in full payment..

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

§ 4.1.9 The Bidder shall execute, under the penalty of perjury, and submit with its Bid, an Iran Divestment Act of 2012 certification as required by General Municipal Law §103-g.

§ 4.1.10 As a condition of bidding, the Bidder certifies, warrants and represents that it is not disqualified to contract with municipal corporations or other public bodies as provided by the General Municipal Law of the State of New York, or as provided by any successor statute thereto. The Bidder further certifies that if it becomes a Contractor hereunder, any refusal by it, including the refusal of its officers, employees, servants or agents, when called before a grand jury, head of a state department, temporary state commission or other state agency, the organized crime task force in the department of law, head of a city department or other city agency, which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation concerning any transaction, or contract had with the state, any political subdivision thereof or of a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transaction or contract, it or any firm, partnership or corporation of which it is a member, partner, director or officer shall be disqualified from selling to or submitting bids or proposals to or receiving awards from or entering into any contract with the Owner for a period of five years after such refusal; and any and all contracts made with the Owner on or after the first day of July, nineteen hundred and fifty nine by it and by any firm, partnership or corporation of which it is a member, partner, director or officer may be cancelled or terminated by the Owner without incurring any penalty or damages on account of such cancellation or termination, but any monies owing by the Owner for goods delivered or work done prior to the cancellation or termination shall be paid.

§ 4.1.11 The Bidder must verify its Bid in writing verifying that the several matters stated therein are in all respects true.

§ 4.1.12 The Owner may consider as informal any Bid on which there is an alteration of or departure from or additions to or qualification of the Bid Form or from the any of the other Contract Documents. The Owner may reject a Bid, which in the Owner's sole view, is not adequately filled out, or does not contain the requested information.

§ 4.1.13 It is the Bidder's responsibility to examine carefully the Drawings and Specifications, proposal and the site upon which the Work is to be performed. A proposal submitted shall be prima facie evidence that the Bidder has made such examination and that it is familiar with all of the conditions and requirements.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:
(Insert the form and amount of bid security.)

Either a certified check drawn on a solvent bank with an office in the State of New York, or a bid bond equal to five percent (5%) of the total amount of the Bid, and payable to the "Bedford Village Fire District." This amount shall be the measure of liquidated damages sustained by the Owner as a result of the failure, negligence or refusal of the Bidder to whom the Contract is awarded to execute and deliver the Contract. The Bid must also be accompanied by a certified statement that the bonding company meets or exceeds the requirements set forth in Article 11 of the General Conditions of the Contract for Construction in the proposed Contract Documents.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder; such bonds shall be in the amount of 100% of the Contract Sum. Should the Bidder refuse to enter into such Contract within 10 days after receipt of the Notice of Award or fail to timely furnish such bonds, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

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

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§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or the Bidder has not been notified of the acceptance of its Bid, the Bidder may, beginning 45 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 Each Bid submission shall be enclosed in a sealed opaque envelope. This envelope shall be clearly marked with the name of the Project, Bidder's name, the date of the Bid opening, and marked "**BID PROPOSAL**" in large lettering on the envelope and shall contain the following items:

- **.1** Certified check or Bid Bond in the amount totaling 5% of the Base Bid.
- **.2** Certified letter from its bonding company, indicating that they meet the criteria set forth in Article 11 of the General Conditions contained in the proposed Contract Documents.
- **.3** Certified letter that the company bidding this Project has been in business under the same name for a period of five years or longer, and is not currently disbarred from bidding or working on public works projects by the New York State Department of Labor.
- **.4** One (1) fully executed original and one (1) copy (marked "copy") of the following:
  - **.1** Proposal form.
  - **.2** Non-collusive form.
  - **.3** Hold Harmless Agreement.
  - **.4** Certification of Compliance with the Iran Divestment Act or Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act.
  - **.5** Insurance Certification - each Bid must be accompanied by the Insurance Certification Form located in the Specifications. Failure to provide may result in the Owner finding the Bidder "nonresponsive" to the Bidding Documents.
  - **.6** Sexual Harassment Prevention Certification form.
- **.5** Bidder Qualifications
  - **.1** A description of its experience with at least five similar projects of comparative size, complexity and cost together with documentary evidence showing that said projects were completed to the owner's satisfaction and were completed in a timely fashion.
  - **.2** Documentation from five projects completed within the past five years, listing type and scope of work, names and addresses of owners and dates of contract completion, as well as the following information:
    - timeliness of performance of the work of the project.
    - evidence that the project was completed to the Owner's satisfaction.
    - whether any extensions of time were requested and if such requests were granted.
    - whether litigation and/or arbitration was commenced by either the Owner or the Bidder as a result of the work of the project completed by the Bidder.
    - whether any liens were filed on the project by subcontractors or material suppliers of the Bidder.
    - whether the Bidder was defaulted on the project by the owner.
    - whether the Bidder made any claims for extra work on the project, including whether said claim resulted in a change order.
  - **.3** Documentation evidencing the Bidder's financial responsibility and capability to produce and execute the Work of the Project within the time periods specified, including a certified financial statement.
  - **.4** Fully completed Statement of Bidder's Qualifications.
  - **.5** Fully completed list of subcontractors.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered. Bids not exhibiting original signatures or seals will not be accepted as a responsive Bid.

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

§ 4.4.3 A Bid may not be modified, withdrawn or canceled by the Bidder during the forty-five (45) day time period following the time and date designated for the receipt of bids and each Bidder so agrees in submitting a Bid. Beginning 45 days after the day of the opening of Bids, a Bidder may withdraw its Bid and request return of its bid security.

§ 4.4.4 Negligence on the part of the Bidder in preparing its Bid confers no right for the withdrawal of the Bid after it has been opened. If the Bidder claims to have made a material and substantial mistake in the preparation of its Bid, the Bidder shall deliver to the Owner a written notice describing in detail the nature of the mistake or error with documentary proof (including, but not limited to, bid worksheets, summary sheets and other bid related data requested of it) within twenty-four (24) hours after the opening of the Bids. Failure to deliver said notice and documentary evidence or proof within the specified time shall constitute a waiver of the Bidder's right to claim an error or mistake. Upon receipt of said notice and documentary evidence within the specified time period, the Owner shall determine if an excusable error or mistake has been made; and, if so, the Owner may permit the Bid to be withdrawn. The Owner's determination of whether a Bidder made an excusable error or mistake shall be conclusive on the Bidder, its Surety, and all those claiming rights under the Bidder.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders. The Owner reserves the right to postpone the date and time of the opening of Bids at any time prior to the date and time listed in the Advertisement or Notice to Bidders.

§ 5.2 Rejection of Bids

§ 5.2.1 The Owner reserves the right to reject any or all Bids and to accept the proposal it deems in the best interest of the Owner. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete, nonresponsive or irregular is subject to rejection by the Owner.

§ 5.2.2 In order to qualify as a Contractor satisfactory to the Owner, the Bidder shall document to the satisfaction of the Owner that he has the skill and experience as well as the necessary facilities, ample financial resources, experienced staff and technical organization for the Work, and adequate laborers and equipment to do the Work in a satisfactory manner and within the time specified. The Bidder may be judged qualified only for the type of work in which it demonstrates competence. The Bidder must prove to the satisfaction of the Owner that it is reputable, reliable and responsible. The Owner may make any investigation it deems necessary to assure itself of the ability of the Bidder to perform the Work, and the Bidder shall furnish the Owner with all such additional information and data for this purpose as may be requested. In addition to the general reservation of rights to reject any and all bids, the Owner specifically reserves the right to reject any Bid of any Bidder if the evidence submitted by, or investigation of such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract Documents and to complete the Work contemplated therein.

§ 5.2.3 The Owner reserves unto itself the sole right to determine the lowest qualified and responsible Bidder. The Owner may make any investigation necessary to determine the ability of the Bidder to fulfill the Contract and the Bidder shall furnish the Owner with all such information for this purpose as the Owner may request. Without limiting the general rights which the Owner has to reject Bids, as herein before set forth, in determining the lowest responsible bidder, the following

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considerations in addition to those above mentioned shall be taken into account. In determining the responsibility of a Bidder for a public works contract, the Owner shall consider whether the Bidder:

.1 Maintains a permanent place of business;
.2 Has adequate plant and equipment to do the Work properly and expeditiously;
.3 Has the suitable financial ability to meet obligations required by the Work;
.4 Has appropriate technical ability and experience in institutional and commercial construction including experience in municipal construction in New York State;
.5 Has performed Work of the same general type and the same scale called for under this Contract;
.6 Has previously failed to perform contracts properly or complete them on time;
.7 Is in a position to perform this Contract;
.8 Has habitually and without just cause neglected the payment of bills or otherwise disregarded its obligations to subcontractors, suppliers, or employees;
.9 Is eligible for full bonding capacity of its Contract;
.10 Has been in business as the corporation, partnership, sole proprietorship or other business entity, in whose name the bid is submitted, continuously, for no less than the previous five (5) years performing or coordinating the Work which it is bidding on;
.11 Is not currently involved in bankruptcy proceedings;
.12 Is licensed to perform the Work it is bidding on in the jurisdiction the work will take place;
.13 Is able to perform the work with manpower available to it;
.14 Will employ a field superintendent with at least five (5) years' experience as a working field superintendent and capable of communicating in fluent English;
.15 Has committed a willful violation of the New York State Prevailing Wage Laws within the last five years;
.16 Has committed violations of safety and/or training standards as evidenced by a pattern of OSHA violations or the existence of willful OSHA violations;
.17 Has committed any significant violation of the Worker's Compensation Law, including, but not limited to, the failure of the Bidder to provide proof of worker's compensation or disability benefits coverage;
.18 Has committed any criminal conduct involving violations of the Environmental Conservation Law or other federal or state environmental statutes of regulations;
.19 Has committed any criminal conduct concerning formation of, or any business association with, an allegedly false or fraudulent Women's or Minority Business Enterprise (W/MBE), or any denial, decertification, revocation or forfeiture of W/MBE status by New York State;
.20 Has been debarred by any agency of the U.S. Government; and
.21 Has engaged in other conduct of so serious or compelling a nature that it raises questions about the responsibility of the Bidder, including, but not limited to submission to the Owner of a false or misleading Statement of Bidder's Qualifications, or in some other form, in connection with a bid for or award of a contract.

§ 5.2.4 No bids will be accepted, and no Contract will be awarded to any employer, contractor, sub-contractor, or its successors, which have been debarred and deemed ineligible to submit a bid on or be awarded any public work contract or subcontract by the New York State Department of Labor – Bureau of Public Work, or the New York City Comptroller's Office.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to enter into separate Prime Contracts with the lowest responsive and responsible bidder, as those criteria are defined and interpreted under the laws of the State of New York regarding competitive bidding for public improvement projects, provided the Bids are submitted in accordance with the requirements of the Bidding Documents and do not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.1.1 The Owner may consider informal any Bid not prepared and submitted in accordance with all provisions of the Bidding Documents.

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

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§ 5.3.3 The acceptance of a Bid will be a notice in writing signed by a duly authorized representative of the Owner by either registered or certified mail sent within forty-five (45) after the Bids have been opened and no other act of the Owner shall constitute the acceptance of a Bid. The acceptance of a Bid shall bind the successful Bidder to execute the Contract as provided hereinafter. The rights and obligations provided for in the Contract shall become effective and binding upon the parties only with its formal execution by the successful Bidder and the Owner.

§ 5.3.4 Each Bidder to whom a contract is awarded, shall, at the office of the Fire District within ten (10) business days after the date of notification by either registered or certified mail of acceptance of its Bid furnish the required payment and performance bonds in an amount of 100% of the Contract Sum, and the required insurance as set forth in Article 11 of the General Conditions of the Contract for Construction, and sign the Contract for the Work for its performance and maintenance.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

(Paragraph deleted)

§ 6.1.1 The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform its obligations under the Contract, and the Bidder shall furnish the Owner all such information and data for this purpose as the Owner may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified and capable to carry out properly the terms of the Contract. The issuing of Bid Documents and acceptance of the Bidder's payment by the Owner shall not be construed as pre-qualification of that Bidder. If the Bidder is later discovered to have misrepresented or provided false or incorrect information with regard to any material party of the information submitted to the Owner, including but not limited to information regarding experience, debarment, claims, lawsuits, arbitrations, mediations, finances, license, contract termination, the Owner reserves the right to reject the Bid of such Bidder and, if a construction contract has been awarded, it will become automatically voidable at the sole discretion and election of the Owner.

§ 6.1.2 Within forty-eight (48) hours after the Bids are opened, the three (3) apparent low Bidders for each Prime Contract must submit the required pre-award submittal package described below to the Construction Manager:

- **.1** Workforce and Work Plan – Provide a detailed written Work Plan which shall demonstrate the Contractor's understanding of overall Project scope and shall include, but not be limited, to the following:
  - **.1** Sequential listing of specific Project activities required to successfully complete the Work of the Contract Documents.
    - **.1** Include Schedule and list Critical Milestones;
    - **.2** Include phasing of the Work, if required.
    - **.3** Include listing of long lead items.
    - **.4** Impact of weather and restricted work period(s).
    - **.5** Statement that the Project can be completed in the established time.
  - **.2** Resumes for the Bidder's proposed supervisory staff, including qualifications for specialized expertise or any certification(s) required to perform the Work.
  - **.3** Any special coordination requirements with other trades.
  - **.4** Any special storage and staging requirements for construction materials.
  - **.5** Any other special requirements.
- **.2** Detailed Cost Estimate: A copy of a Detailed Cost Estimate outlined in CSI format.
- **.3** Copy of most recent financial statements from CPA.
- **.4** AIA A305 – Qualification Form.

§ 6.2 Owner's Financial Capability – Intentionally omitted

§ 6.3 Submittals

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

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- **.3** names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if the Owner, Construction Manager or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity. The Owner may accept the substituted person or entity in its sole discretion or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security shall not be forfeited.

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 The Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Refer to Article 11 of the AIA A232-2019 General Conditions of the Contract for Construction for requirements associated with such bonds.

§ 7.1.2 The cost of the performance and payment bonds shall be included in the Bid.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the penal sum of the payment and performance bonds shall be the amount of the Contract Sum.
(Paragraphs deleted)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than ten (10) days following the date of notice of award of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312-2010, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum. The Bidder shall provide for the continuation of the Performance Bond for two (2) full years after date of final payment request at the full Contract Sum.

§ 7.2.2.1 The performance and payment bonds shall have as surety thereunder such surety company or companies as are acceptable to Treasury Department of the United States on Bonds given to the United States Government, are authorized to do business in the State of New York, and meet or exceed the requirements established in Article 11 of the General Conditions of the Contract for Construction. The premiums on such bonds shall be included in the Bid price.

§ 7.2.3 The bonds shall be dated as of the date of the Contract.

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

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A132-2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, as modified.
(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)

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SECTION 00 25 13 – PRE-BID MEETING

1.1 PRE-BID MEETING

A. Construction Manager & Architect will conduct a virtual Pre-Bid meeting as indicated below:

1. Pre-bid Date: Tuesday March 16, 2021
   Pre-bid Time: 10:00 am
2. Location: Virtual Invite and access information will be sent to all plan holders two days prior to the meeting.

B. Attendance:
1. Prime Bidders: Attendance at Prebid meeting is recommended.
2. Subcontractors: Attendance at Prebid meeting is recommended.

C. Agenda: Pre-bid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
1. Procurement and Contracting Requirements:
   a. Bid Date & Time
   b. Address/location of bid drop-off (virtual opening)
   c. Prevailing Wage/OSHA 10 project
   d. Instructions to Bidders.
   e. Bonding.
   f. Insurance.
   g. Bid Submittal Requirements (Bond, Insurance Certification Form, AIA 305 Contractors Qualification Statement, Non-Collusive, Iran Divestment, Addenda Acknowledgement)

2. Separate Contracts
   a. Multi – Prime Contract (SC, GWC, MC, EC, PC, FPC)
   b. Work by owner

3. Communication during Bidding Period:
   a. Obtaining documents.
   b. Bidder's Requests for Information (send to CM for log-in and distribution to appropriate responder)
   c. Bidder's Substitution Request/Prior Approval Request.
   d. Addenda.

4. Construction Documents:
   a. Summary of Work (Prime Contractor Responsibilities)
   b. Contractor Special Notes

c. Allowances
d. Unit Prices
e. Alternates
f. Temporary Facilities (Prime Contractor Responsibilities)
g. Work Restrictions.

5. Schedule:
   a. Project Schedule.
   b. Contract Time.
   c. Bidder Questions.

6. Site/facility visit or walkthrough. - will be held March 17, 2021 and must be scheduled in advance through Frank Roberts of ACCI (914)755-0930. Visit times will be scheduled in small groups, PPE and social distancing must be maintained,

D. Minutes: Construction Manager will record and distribute meeting minutes to those known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurements and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
   1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT

SECTION 00 31 32 – GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A Geotechnical Engineering Evaluation report for Project, prepared by Carlin-Simpson & Associates, dated September 10, 2019, is available for viewing as appended to this Document.

C. Related Requirements:

1. Document 00 10 01 – Instructions to Bidders for the Bidder's responsibilities for examination of Project site and existing conditions

END OF DOCUMENT

CARLIN • SIMPSON & ASSOCIATES

Consulting Geotechnical and Environmental Engineers

61 Main Street, Sayreville, New Jersey 08872
Tel. (732) 432-5757
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Principal:
Robert B. Simpson, P.E.

Associates:
Meredith R. Anke, P.E.
Stephen Rossi, P.E.
Kurt W. Anke
Eric J. Shaw

10 September 2019

Sullivan Architecture
31 Mamaroneck Ave.
White Plains, NY 10601

Attn: Mr. Chris J. Pelella

Re: Report on Subsurface Soil and Foundation Investigation
Proposed Building-New Fire Station
550 Old Post Rd.
Bedford, NY (CSA Job #19-160)

Dear Mr. Pelella:

In accordance with our proposal revised 6 August 2019 and your subsequent authorization, we have completed a Subsurface Soil and Foundation Investigation for the referenced site. The purpose of this study was to determine the nature and engineering properties of the subsurface soil and the groundwater conditions for the new construction, to recommend a practical foundation scheme, and to determine the allowable bearing capacity of the site soils. We understand that the planned construction will consist of a new municipal firehouse.

Our scope of work for this project included the following:

1. Reviewed the proposed layout, the existing site conditions, the expected soil conditions, and planned this study.

2. Retained General Borings Inc. to advance two (2) borings the site.

3. Laid out the boring locations in the field, visually identified the soil layers encountered, obtained soil samples, and prepared detailed boring logs and a Boring Location Plan.

4. Performed laboratory soil identifications tests on selected representative soil samples.

5. Analyzed the field and laboratory test data and prepared this report containing the results of this study.

1.0 SITE DESCRIPTION

The site is located at 550 Old Post Road in Bedford, New York. The site is currently heavily wooded. Some abandoned structures are present in the area of the proposed building. The site grades generally slope down from south to north. Existing grades vary from approximately +377.0 to +362.0.

2.0 PROPOSED CONSTRUCTION

We understand that the planned construction will consist of a new single story fire station. We understand that the proposed building will have a finished floor elevation of +374.25. The building loads were not known at the time of writing this report.

The following evaluation is based on information that has been provided to our office as of the date of this report. Once the planned construction has been further completed, a copy of the final plans should be forwarded to our office so that we can review it along with the recommendations in this report. At that time, any changes or additional recommendations can be provided, if required.

3.0 SUBSURFACE CONDITIONS

To determine the subsurface soil and groundwater conditions at the site, two (2) test borings were advanced by General Borings, Inc. at the locations shown on the enclosed Boring Location Plan. The borings were performed using hollow stem augers and split spoon sampling. Detailed boring logs have been prepared and are included in this report. The borings were completed in under the full-time inspection of Carlin-Simpson & Associates. Our field engineer visually identified all of the soil samples obtained during the boring operations and selected samples were tested in our laboratory. In addition, we have been provided with eight (8) additional borings performed by JHB Engineering Inc. in October 2018. The results of these borings are attached at the end of this report.

3.1 Soils

The soil descriptions shown on the boring logs are based on the Burmister Classification System. In this system, the soil is divided into three components: Sand (S), Silt ($) and Gravel (G). The major component is indicated in all capital letters, the lesser in lower case letters. The following modifiers indicate the quantity of each lesser component:

Modifier	Quantity
trace (t)	0 -10%
little (l)	10% - 20%
some (s)	20% - 35%
and (a)	35% - 50%

The subsurface soil conditions encountered in the test borings (B-101 and B-102) in the building area can be summarized as follows:

Stratum 1 Topsoil — At the surface in each boring is topsoil that ranges from approximately 8 to 12 inches in thickness.

Stratum 2 Sand — Below the surface topsoil in each boring is medium dense brown coarse to fine SAND, trace Silt, trace coarse to fine Gravel that extends to depths of 7'0" and 10'0" below the existing ground surface in borings B-101 and B-102, respectively.

Stratum 3 Sandy Silt — Below the Sand in each boring is soft to stiff Silt little (to some), fine Sand with Clayey Silt layers. Borings B-101 and B-102 were terminated in this stratum at depths of 52'0" below the existing ground surface.

3.2 Groundwater

Observations for groundwater were made during sampling and upon completion of the drilling operations at each boring location. Groundwater was encountered throughout the site at depths ranging from 4'0" to 6'0" (elevations +374.0 to +370.5) below the existing ground surface. We do not anticipate that groundwater will be encountered during construction.

Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration.

3.3 Summary of Boring Observations

A summary of the observations of the borings performed in the building area is provided in Table 1 below.

Table 1 – Summary of Boring Observations (Building Area)

Boring No.	Existing Ground Surface Elevation	Depth to Groundwater (Elevation)	Depth to Bottom of Sandy Silt (Elevation)	Depth to Bedrock (Elevation)
B-101	+370.5	6'0" (+364.5)	NE to 52'0"	NE to 52'0"
B-102	+374.0	5'6" (+368.5)	NE to 52'0"	NE to 52'0"
SB-1	+371.0	5'6" (+365.5)	NE to 52'0"	NE to 52'0"
SB-2	+371.0	6'0" (+365.0)	73'6" (+292.5)	NE to 82'0"
SB-3	+374.0	5'6" (+368.5)	61'6" (+312.5)	CWR @ 73'6" (+300.5)
SB-4	+373.0	6'0" (+367.0)	NE to 52'0"	NE to 52'0"
SB-5	+372.0	5'0" (+365.0)	65'0" (+307.0)	C @ 65'0" (+307.0)
SB-6	+375.0	6'0" (+369.0)	NE to 17'0"	NE to 17'0"
SB-7	+372.0	6'0" (+364.5)	NE to 17'0"	NE to 17'0"
SB-8	+371.0	4'0" (+367.0)	NE to 17'0"	NE to 17'0"

NE – Not encountered
C – Cored bedrock
CWR – Completely Weathered Rock

4.0 SUMMARY OF DESIGN RECOMMENDATIONS

Below is a summary of the major design and construction considerations for this project. Additional recommendations are provided in the following sections of this report.

- *Subsurface Conditions (Section 3.0)*
  - The subsurface conditions generally consist of medium dense virgin Sand that is underlain by Sandy Silt.
  - Bedrock was encountered at depths ranging of 73’6” and 65’0” below the existing ground surface.
  - Groundwater was not encountered to depths of 4’0” to 6’0” below the existing ground surface.
  - A summary of the subsurface observations is provided in Table 1 above.

- *Building Area Preparation (Section 5.1)*
  - Existing structures must be demolished and surface materials must be stripped from the proposed construction area.
  - Existing fill must be completely removed from the building areas.
  - New backfill shall be compacted to at least 95% of its Maximum Modified Dry Density (ASTM D-1557).

- *Building Foundation Recommendations (Section 5.2)*
  - Existing fill, which may be encountered in the area of existing structures is not suitable for support of the building foundations or floor slab.
  - The existing fill associated with the removal of existing structures shall be completely removed from the building areas.
  - The new foundations may be designed as spread footing type foundations bearing on virgin soil or engineer-approved compacted fill.
  - Net design bearing pressure = 3,000 psf.
  - Minimum depth for frost protection = 42 inches.
  - Seismic Site Class = E – Soft Soil Profile.

- *Building Floor Slab Recommendations (Section 6.3)*
  - New compacted fill or virgin soils are suitable for the proposed floor slab.
  - The floor slab may be designed as slab on grade.
  - Modulus of subgrade reaction = 200 pci.

- *Additional Site Recommendations*
  - Pavement (Section 7.1): Densified existing fill, virgin soil, and new compacted fill may be used to support the pavement.
  - Utilities (Section 7.2): New utilities may bear in the virgin soil or new compacted fill.

5.0 BUILDING EVALUATION

We understand that the planned construction will consist of a new single story fire station. The existing site grades in the building footprint vary from approximately elevation +374.5 to +371.0. The proposed finished floor elevation is +374.25. As a result, minor cuts of less than 1 foot and fills of up to approximately 3 feet are necessary for construction of the planned structure. The building loads were not known at the time of writing this report.

An abandoned structure/foundation is noted in the western half of the proposed building. Any associated debris or existing fill present in this area must be completely removed from the new building area and replaced with new compacted fill as described below.

Provided that the existing fill and any other unsuitable materials encountered during construction are removed, it is our opinion that the new structural fill or virgin Sand (Stratum 2) can adequately support the new building foundations and floor slab. Recommendations for building area preparation are provided in Sections 5.1 below. Foundation recommendations are provided in Section 5.2 below. In addition, the proposed building floor slab may be designed as slab on grade bearing on new compacted fill or virgin soils. Floor slab recommendations can be found in Section 5.3 below.

5.1 Building Area Preparation

As part of the site development, any existing or abandoned structures, on the site will be demolished. All debris resulting from the demolition of these structures must be completely removed from the new building area, extending at least ten (10) feet beyond the new building limits, where practical. This shall include the complete removal of all foundations, walls, floor slabs, utilities, pavement, and miscellaneous debris. Where the removal of existing structures or associated materials extends below the planned buildings, the resulting excavations shall be backfilled with new compacted fill as described below.

Removal of Existing Fill

Any existing fill in the area of existing or abandoned structures must be completely removed from the building footprint and replaced with new compacted fill. We recommend that a series of supplemental test pits be performed at the time of construction to further evaluate the existing fill conditions in and around the planned building area. The test pits should be conducted under the full time observation of a Carlin-Simpson & Associates representative. These test pits will allow us to determine the horizontal and vertical limits of the unsuitable material within the proposed building area.

After the surface materials are removed, the existing fill shall be excavated from the limits of the new building area. The removal of the existing fill from the proposed building area shall extend through the existing fill, down to the virgin soil. At the bottom of the excavation, the removal of the unsuitable material shall extend horizontally beyond the building limits a minimum distance of one (1) foot plus a distance equal to the depth of the excavation below the planned foundation bearing elevation. For example, if the removal of the existing fill extends

vertically two (2) feet below the planned foundation bearing elevation, the excavation must extend horizontally a minimum of three (3) feet (1 foot plus 2 feet) beyond the new building limits at that location.

The removal of the existing fill from the proposed building area shall be performed under the full time inspection of Carlin-Simpson & Associates. The on-site representative from Carlin-Simpson & Associates shall direct the Contractor during this operation to ensure that all of the unsuitable material has been removed from the proposed building area.

During the removal of the unsuitable material from the building area, the Contractor should segregate the potentially re-usable existing fill material from the non-reusable fill (i.e. debris and topsoil). The on-site representative from Carlin-Simpson & Associates shall evaluate the suitability of the excavated materials for use as compacted fill during the excavation and prior to its re-use. Potentially usable fill should be stockpiled and covered with tarps or plastic sheeting for protection from excess moisture. Any fill material that is or becomes wet must be dried prior to its re-use.

After the surface materials and existing fill have been removed and prior to the placement of new structural fill, the exposed subgrade must be graded level and proofrolled by several passes of a vibratory drum roller. The proofrolling operation is necessary to densify the underlying soils. Carlin-Simpson & Associates shall be retained to observe the proofrolling of the subgrade. If any soft or otherwise unsuitable soils are noted, the unsuitable material shall be removed and replaced with new structural fill. Carlin-Simpson & Associates shall be responsible for determining what material, if any, is to be removed and will direct the Contractor during this operation.

Installation of New Structural Fill

New fill required to achieve final grades shall consist of either engineer-approved on-site soil or imported sand and gravel. Imported sand and gravel shall contain less than 20% by weight passing a No. 200 sieve. The new fill shall be placed in layers not exceeding one (1) foot in thickness and each layer shall be compacted to at least 95% of its Maximum Modified Dry Density (ASTM D1557). Each layer must be compacted, tested, and approved the Carlin-Simpson & Associates field representative prior to placing subsequent layers. The suitability of the excavated soil for reuse as compacted structural fill is discussed in Section 6.3 below.

If imported structural fill will be required during construction, the imported structural fill shall meet the following specified gradation:

US Standard Sieve Size	Percent Finer By Weight
3 inch	100
No. 4	30-80
No. 40	10-50
No. 200	0-20

5.2 New Building Foundations

Once the planned building area and subgrade has been prepared as described Section 5.1 above, the new foundations may be constructed on new compacted fill, virgin site soils, or bedrock. The new building foundations may be designed as a shallow spread footings using the net design bearing pressures as listed in the Table 4 below.

Any existing fill associated with the demolition of existing or abandoned structures. The existing fill shall be completely removed from the building area as described above. All foundations shall bear on the virgin soil or on new engineer-approved compacted fill. All of the exterior footings shall bear at the minimum depth listed below for protection from frost, however we anticipate that footings will extend deeper than the minimum frost depth to bear below the existing fill. Interior column footings may bear on the virgin soil or new structural fill just below the floor slab provided the building is heated during winter. The footings shall have minimum dimensions as listed below.

Table 2 – Foundation Design Parameters

Description	Value
Foundation Bearing Material	Virgin Soil or New Compacted Fill
Net Design Bearing Pressure	3,000 psf
Minimum Frost Depth	42 inches
Minimum Column Dimension	30 inches
Minimum Wall Dimension	18 inches

The excavations for the new foundations shall be performed under the full-time inspection of Carlin-Simpson & Associates or a qualified geotechnical engineering firm. The on-site representative shall confirm that the foundation bearing material is capable of supporting the design bearing pressure.

Prior to the installation of the reinforcement steel and concrete, the bottoms of the foundation excavations should be cleaned of all loose material. The foundation subgrade shall be compacted with a small vibratory drum trench compactor (i.e. Wacker Model RT560), a heavy vibratory plate tamper (i.e. Wacker BPU 3545A or equivalent), or a “jumping jack” style tamper (i.e. Wacker Model BS 600). The preparation of the footing bearing subgrade should be performed under the observation of a representative from Carlin-Simpson & Associates. If instability is observed during the compaction of the bearing subgrade, the soft soil shall be removed and replaced with new compacted fill.

5.3 Floor Slab on Grade

We understand that the proposed floor slab will be used to support heavy equipment. The floor slab may be designed as a slab on grade bearing on densified existing fill, densified virgin soil, or on new engineer-approved structural fill. However, due to the heavy loads anticipated for this slab we recommend a thickness minimum of 8-inches. The floor slab design parameters are

provided in Table 3 below. A layer of 3/4-inch crushed stone is recommended beneath the concrete slab for additional support and drainage.

Table 3 – Floor Slab Design Parameters

Description	Value
Slab Subgrade Material	Densified Virgin Site Soils, Densified Existing Fill or New Compacted Fill
Modulus of Subgrade Reaction (k)	200 pci
Concrete Slab Thickness Minimum	6 inches
Crushed Stone Cushion Thickness	8 inches

New fill for the floor slabs shall consist of either suitable on-site soil or imported sand and gravel. Imported sand and gravel shall contain less than 20% material by weight passing a No. 200 sieve. The new fill shall be placed in layers not exceeding one (1) foot in loose thickness and each layer shall be compacted to at least 95% of its Maximum Modified Dry Density (ASTM D1557). Fill layers shall be compacted, tested, and approved before placing subsequent layers.

5.4 Building Settlement

Settlement of individual footings, designed in accordance with recommendations presented in this report, is expected to be within tolerable limits for the proposed structure. For footings placed on natural soils or new compacted fill approved by Carlin-Simpson & Associates and constructed in accordance with the requirements outlined in this report, maximum total settlement is expected to be on the order of 1-inch or less. Maximum differential settlement between adjacent columns or load bearing walls is expected to be half the total settlement.

The above settlement values are based on our engineering experience with similar soil conditions and the anticipated structural loading, and are to guide the structural engineer with his design. To minimize difficulties during the foundation installation phase, it is critical that Carlin-Simpson & Associates be retained to observe the foundation bearing surfaces and to confirm the recommended bearing pressures and that the existing fill and unsuitable materials have been removed from beneath the new foundations.

5.5 Seismic Design Considerations

From the site-specific test boring data, the Seismic Site Class was determined using the International Building Code – New York State Edition and Table 20.3-1 of ASCE 7-10. The site-specific data used to determine the Site Class typically includes soil test borings to determine Standard Penetration resistances (N-values) in the upper 100 feet of soil profile. Based on estimated average N-values in the upper 100 feet of soil profile, the site can be classified as Site Class E – Soft Soil Profile.

New structures should be designed to resist stress produced by lateral forces computed in accordance with Section 1613 of the International Building Code – New York State Edition. The values in Table 7 shall be used for this project.

Table 4 – Seismic Design Values

Mapped Spectral Response Acceleration for Short Periods, [Fig 22-1]	S_S=0.272g
Mapped Spectral Response Acceleration at 1-Second Period, [Fig 22-2]	S_1=0.060g
Site Coefficient [Table 11.4-1]	F_a=2.34
Site Coefficient [Table 11.4-2]	F_v=4.20
Max Considered Earthquake Spectral Response for Short Periods [Eq 11.4-1]	S_{MS}=0.636g
Max Considered Earthquake Spectral Response at 1-Second Period [Eq 11.4-2]	S_{M1}=0.251g
Design Spectral Response Acceleration for Short Periods [Eq 11.4-3]	S_{DS}=0.424g
Design Spectral Response Acceleration for 1-Second Period [Eq 11.4-4]	S_{D1}=0.167g

6.0 SITE EVALUATION

Our recommendations for the proposed site development including the new utilities and the suitability of the existing site soils for reuse as structural fill are provided below.

6.1 Pavement

We understand that the proposed construction will also include new asphalt paved parking areas and driveways. We expect that varying cuts and fills will be required to achieve the planned subgrade elevations in the new pavement areas. Densified existing fill or virgin site soils, and new compacted fill may be used to support the pavement.

To prepare the new pavement areas, the existing surface materials (i.e. topsoil, vegetation, etc.) must be removed from the planned pavement areas. In the proposed pavement areas, the existing structures and debris resulting from the demolition of these structures must be completely removed from the new pavement area, extending at least five (5) feet beyond the new paving limits, where practical. The excavations resulting from the removal of existing structures shall be backfilled using controlled compacted fill. New fill shall consist of either suitable on-site soil or imported sand and gravel placed in one (1) foot loose layers and compacted to at least 92% of its Maximum Modified Dry Density (ASTM D-1557).

After all surface materials have been removed, the area can be excavated to the planned subgrade elevation. Where soil is encountered at the subgrade elevation, the subgrade shall be proofrolled with a large vibratory drum roller (i.e. Dynapac 250 or equivalent) to densify the underlying soils. The on-site representative from Carlin-Simpson & Associates shall witness the proofrolling operation. If any excessive movement is noted during the proofrolling, the soft or unsuitable soil shall be removed and replaced with new compacted fill.

Where new fill is required to achieve final grades, it shall consist of either suitable on-site soil or imported sand and gravel. Imported sand and gravel shall contain less than 20% by weight passing a No. 200 sieve. New fill shall be placed in layers not exceeding one (1) foot in loose

thickness and each layer shall be compacted to at least 92% of its Maximum Modified Dry Density (ASTM D-1557). After the planned subgrade has been proofrolled and new compacted fill has been placed as required, the new pavement subbase may be placed on the existing site soils, bedrock, and new compacted fill.

A minimum of six (6) inches of dense graded aggregate (DGA) or crushed stone is recommended for sub-pavement drainage and additional pavement support. We recommend that the following pavement sections be used for the parking lots and driveways. This pavement section is subject to local government approval.

Asphalt Pavement Section

The new pavement subbase may be placed on engineer-approved densified existing fill, virgin soil, or new compacted fill. A minimum of six (6) inches of dense graded aggregate (DGA) is recommended for the subbase layer for drainage and additional pavement support. We recommend that the following pavement section be used for the parking lots and driveways. This pavement section is subject to local government approval.

2”	Asphalt Top Course	NYSDOT, Type 6F
4”	Asphalt Base Course	NYSDOT, Type 3
8”	Stone Subbase (DGA)	NYSDOT, Type 1
	Approved Compacted Subgrade (Minimum CBR = 10)	

Rigid (Concrete) Pavement

We understand that concrete pavement will be used in portions of the site. Typically, a five (5) inch thick, 4,000-psi concrete section supported on six (6) inches of dense graded aggregate (DGA) base and an approved compacted subgrade is adequate for passenger vehicle traffic and occasional truck traffic.

Based on the boring data and the laboratory test results, we anticipate that the densified site soils and new compacted fill will provide a CBR value that is equal to or greater than 10, which can adequately support the above pavement sections.

6.2 Utilities

New utilities may bear in the existing site soils or new compacted fill. The bottom of all trenches should be excavated clean and shaped so a hard bottom is provided for the pipe support. If any soft or unsuitable soil conditions are encountered during construction, the unsuitable materials must be removed and replaced with new compacted fill.

Trench blasting will be required to install the new utilities in portions of the site where rock is encountered above the planned utility invert elevation. Where rock is encountered in the utility excavations, it must be removed to at least six (6) inches below planned pipe invert. The over-excavated six (6) inches shall then be filled with new sandy fill and compacted to at least 92% of its Maximum Modified Dry Density (ASTM D-1557) to act as a cushion on the rock.

In the event that the trench bottom becomes soft due to the inflow of surface or trapped water, the soft soil shall be removed and the excavation filled with a minimum of six (6) inches of 3/4-inch clean crushed stone to provide a firm base for support of the pipe. Sump pits and pumps should be adequate to keep the excavations dry.

After the utility is installed, the trench must be backfilled with compacted fill. The fill shall consist of suitable on-site soil or imported sand and gravel. Imported fill shall contain less than 20% by weight passing a No. 200 sieve. Large rock fragments and boulders must not be placed directly against the pipe. Controlled compacted fill shall be placed in one (1) foot loose layers and each layer shall be compacted to at least 92% of its Maximum Modified Dry Density (ASTM D-1557). The backfill must be free of topsoil, debris, and large boulders or rock fragments.

6.3 Suitability of the In-Situ Soils for Use as Compacted Fill

The suitability of each soil stratum for use as compacted fill is discussed below. Structural fill shall meet the gradation requirements of the NYC Building Code.

Stratum 1 Topsoil	Topsoil is not suitable for use as compacted fill. During construction, it shall be stripped and removed from the construction area.
Stratum 2 Sand	Stratum 2 generally consists of brown coarse to fine Sand, trace Silt, trace fine Gravel. This portions of this stratum that may be excavated from above the groundwater table are generally suitable for reuse as compacted fill.

The boring observations indicate that the site soils that may be excavated (Stratum 2) may contain a low percentage of silt (3.3%). If the soil becomes too wet, it will be difficult to achieve adequate compaction. In addition, the site soils that extend below the groundwater table are completely saturated and therefore, unsuitable for reuse.

Proper moisture conditioning of the soil will be required. New compacted fill should be within 2% (+/-) of its optimum moisture content at the time of placement. In the event that the on-site material is too wet at the time of placement and cannot be adequately compacted, the soil should be aerated and allowed to dry or the material removed and a drier cleaner fill material used. In the event that the on-site material is too dry at the time of placement and cannot be adequately compacted, water may be needed to increase the soil moisture content for proper compaction.

The in-situ soils which exist throughout the site may become soft and weave if exposed to excessive moisture and construction traffic. The instability will occur quickly when exposed to these elements and it will be difficult to stabilize the subgrade. We recommend that adequate site drainage be implemented early in the construction schedule and if the subgrade becomes wet, the contractor should limit construction activity until the soil has dried. The minimum compaction requirements for the various areas of the site are summarized in Table 7 below.

Table 7 - Minimum Compaction Requirements

Area	Maximum Modified Dry Density (ASTM D-1557)
Building (below foundations)	**95%**
Building Slab (above foundations)	92%
Adjacent to Sign Foundations	92%
Pavement Areas	92%
Exterior Slabs and Sidewalks	92%
Utility Trenches	92%
Landscape Areas	90%

7.0 GENERAL

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study and our past experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for Carlin-Simpson & Associates to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings and test pits will differ from those encountered at specific boring or test pit locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this geotechnical report are not final. Field observations and foundation installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, Carlin-Simpson & Associates should be retained by the Owner to observe all earthwork and foundation construction, to document that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations Carlin-Simpson & Associates is not responsible or liable for the conclusions and recommendations presented in this report if Carlin-Simpson & Associates does not perform the observation and testing services.

Therefore, in order to preserve continuity in this project, the Owner must retain the services of Carlin-Simpson & Associates to provide full time geotechnical related monitoring and testing during construction. At a minimum, this shall include the observation and testing of the following: 1) the removal of existing fill and unsuitable soil, where required; 2) the proofrolling of the subgrade soil prior to the placement of new compacted fill; 3) the placement

and compaction of controlled fill; 4) the excavation for the building foundations; and 5) the preparation of the subgrade for the floor slabs.

This report has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty is expressed or implied. The evaluations and recommendations presented in this report are based on the available project information, as well as on the results of the exploration. Carlin-Simpson & Associates should be given the opportunity to review the final drawings and site plans for this project to determine if changes to the recommendations outlined in this report are needed. Should the nature of the project change, these recommendations should be re-evaluated.

This report is provided for the exclusive use of and the project specific design team and may not be used or relied upon in connection with other projects or by other third parties. Carlin-Simpson & Associates disclaims liability for any such third party use or reliance without express written permission. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. Carlin-Simpson & Associates is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

If the conditions encountered during construction vary significantly from those stated in this report, this office should be notified immediately so that additional recommendations can be made.

Thank you for allowing us to assist you with this project. Should you have any questions or comments, please contact this office.

Very truly yours,

CARLIN-SIMPSON & ASSOCIATES

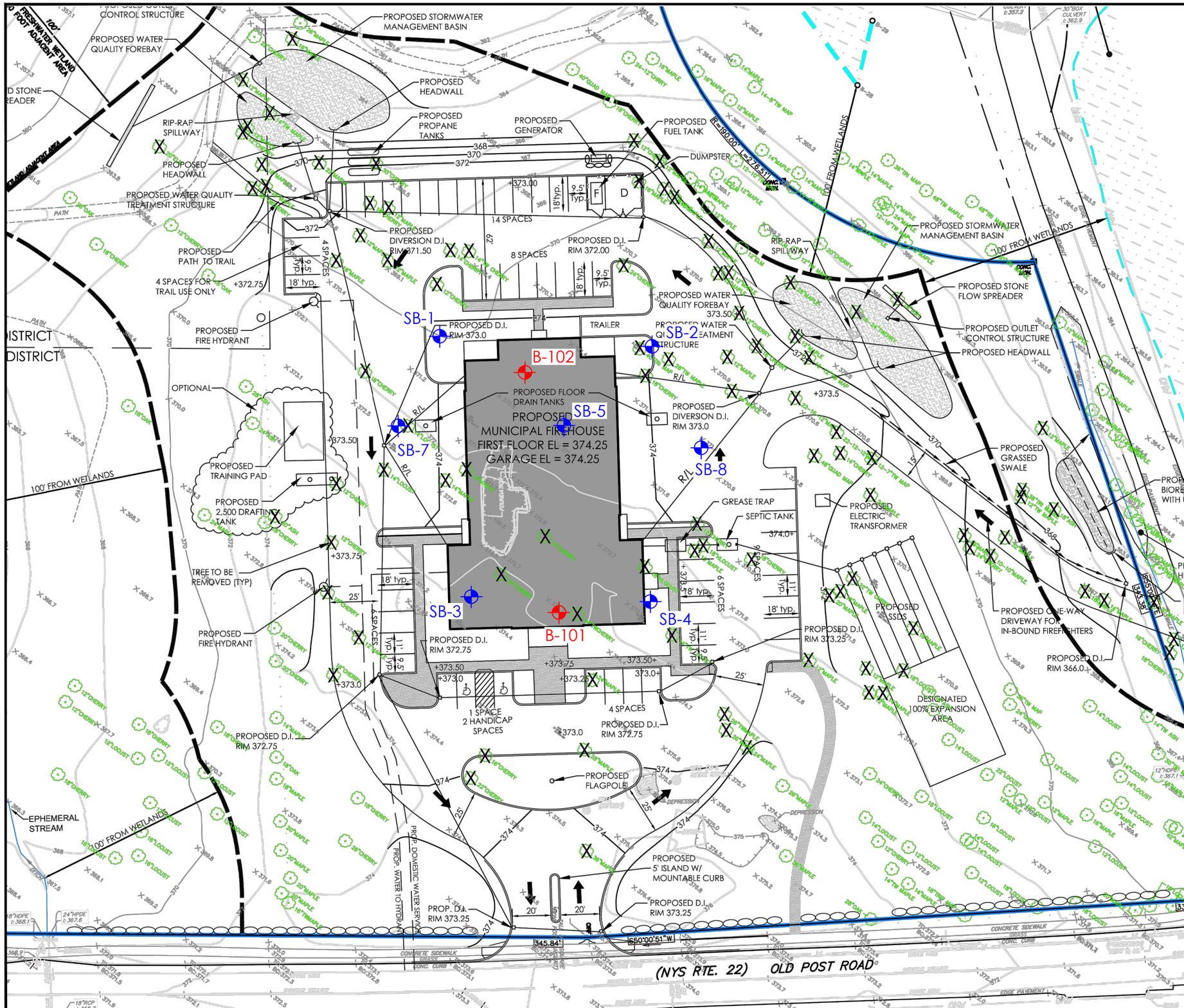
Stephen Rossi

STEPHEN ROSSI, P.E.
Project Manager

Robert Simpson

ROBERT B. SIMPSON, P.E.

File No. 19-160



GENERAL NOTES:

1. GENERAL LAYOUT WAS OBTAINED FROM A DRAWING THAT WAS PREPARED BY BADERN LAND PLANNING AND ENGINEERING, P.C., ENTITLED "INTEGRATED SITE PLAN"', DATED 10/22/2018.
2. BORING LOCATIONS WERE LAID OUT IN THE FIELD BY CARLIN-SIMPSON & ASSOCIATES (CSA).
3. THE BORING WAS PERFORMED BY GENERAL BORINGS INC. IN AUGUST 2018 UNDER THE FULL TIME INSPECTION OF CSA.
4. LOCATIONS ARE APPROXIMATE.

LEGEND:

- JHB ENGINEERING BORING LOCATION (OCT-18)
- CSA BORING LOCATION

ROBERT B. SIMPSON, P.E.
PROFESSIONAL ENGINEER

LICENSE NO. | SIGNATURE | DATE

BORING LOCATION PLAN

PROP. NEW FIRE STATION
550 OLD POST ROAD
BEDFORD, NEW YORK

DRAWN: SR	SCALE: 1" = 50'
CHECKED: RBS	DATE: 9-SEP-17
PROJECT NO.: 19-160	DWG NO.: FIG - 1
APPROVED	

CARLIN-SIMPSON AND ASSOCIATES
61 Main Street
Sayreville, NJ 08872

Consulting Geotechnical and Environmental Engineers

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-101

Project:	**Prop New Fire Station, 550 Old Post Rd, Bedford NY**	**SHEET NO.:**	1 of 3
Client:	**Sullivan Architecture**	**JOB NUMBER:**	19-160
Drilling Contractor:	**General Borings Inc.**	**ELEVATION:**	+374.0
GROUNDWATER		**DATUM:**	

					CASING	SAMPLE	CORE	TUBE		
DATE	**TIME**	**DEPTH**	**CASING**	**TYPE**	**HSA**	**SS**			**START DATE:**	16-Aug-19
16-Aug-19	**1100**	**6'0"**	**HSA**	**DIA.**	**3 1/4"**	**1 3/8"**			**FINISH DATE:**	16-Aug-19
				WGHT		**140#**			**DRILLER:**	JW
				FALL		**30"**			**INSPECTOR:**	JP

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
			1		**Topsoil** 0'8"	
1		**S-1**	1		Br mf S, t $	Rec =12"
			1			moist
2			1			
			2			
3		**S-2**	2		same	Rec = 18"
			4			moist
4			2			
					Brown medium to fine SAND, trace Silt	
5						
			4			
6		**S-3**	8		same, cf S, t (+) cf G	Rec = 9"
			10			moist-wet
7			16			
			11			
8		**S-4**	14		same	Rec = 15"
			12			wet
9			11			
10					10'0"	
			2			
11		**S-5**	1		Br, gr $ s, f S, w/ Cy$ lyrs	Rec = 10"
			4			wet
12			8			
13						
14						
15					**Brown, gray SILT, some fine Sand with Clayey Silt layers**	
			7			
16		**S-6**	8		same, a $	Rec = 17"
			8			wet
17			9			
18						
19						
20						
			8			
21		**S-7**	9		same	Rec = 20"
			8			wet
22			10			

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-101
Project:	**Prop New Fire Station, 550 Old Post Rd, Bedford NY**	**SHEET NO.:** 2 of 3
Client:	**Sullivan Architecture**	**JOB NUMBER:** 19-160

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
23						
24						
25						
26		**S-8**	6 9 10 11		Br, gr $ s, f S, w/ Cy$ lyrs	Rec = 15" wet
27						
28						
29						
30					**Brown, gray SILT, some fine Sand with Clayey Silt layers**	
31		**S-9**	6 6 5 7		same	Rec = 17" wet
32						
33						
34						
35						
36		**S-10**	WOH/12 5 6		same, gr a Cy $	Rec = 20" wet
37						
38						
39						
40						
41		**S-11**	3 4 5 6		same	Rec = 20" wet
42						
43						
44						
45						
46		**S-12**	WOH 5 6 5			Rec = 20" wet
47						

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-101
Project:	**Prop New Fire Station, 550 Old Post Rd, Bedford NY**	**SHEET NO.:** 3 of 3
Client:	**Sullivan Architecture**	**JOB NUMBER:** 19-160

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
48						
49					**Gray SILT little, fine Sand with Clayey Silt layers**	
50						
51		**S-13**	4 8 8 9		Gr $, l f S w/ Cy$ lyrs	Rec = 18" wet
52					52'0"	
53					**End of Boring @ 52'0"**	
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-102

Project:	**Prop New Fire Station, 550 Old Post Rd, Bedford NY**	**SHEET NO.:**	1 of 3
Client:	**Sullivan Architecture**	**JOB NUMBER:**	19-160
Drilling Contractor:	**General Borings Inc.**	**ELEVATION:**	+370.5
GROUNDWATER		**DATUM:**	

DATE	TIME	DEPTH	CASING	TYPE	CASING	SAMPLE	CORE	TUBE	START DATE:	16-Aug-19
26-Aug-19	1400	5'6"	HSA	DIA.	3 1/4"	1 3/8"			FINISH DATE:	16-Aug-19
				WGHT		140#			DRILLER:	JW
				FALL		30"			INSPECTOR:	JP
					HSA	SS				

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
			2		**Topsoil**	
1		S-1	2		1'0"	Rec = 10"
			3		Br mf S, t (+) $	moist
2			2			
			3			
3		S-2	4		same, cf S, t cf G	Rec = 12"
			6			moist
4			10		**Brown corase to fine SAND, trace (+) Silt, trace coarse to fine Gravel**	
5						
			7			
6		S-3	9		same, l (-) cf G	Rec = 13"
			9			moist-wet
7			8		7'0"	
			7			
8		S-4	7		Br, gr $ l, f S, w/ Cy$ lyrs	Rec = 12"
			7			wet @ tip
9			8			Slightly mottled
10						
			4			
11		S-5	2		same, br	Rec = 12"
			3			wet
12			4			
13					**Brown, gray SILT little, fine Sand with Clayey Silt layers**	
14						
15						
			6			
16		S-6	5		same, br, gr	Rec = 11"
			5			wet
17			6			
18						
19						
20						
			4			
21		S-7	7		same	Rec = 18"
			6			wet
22			7			

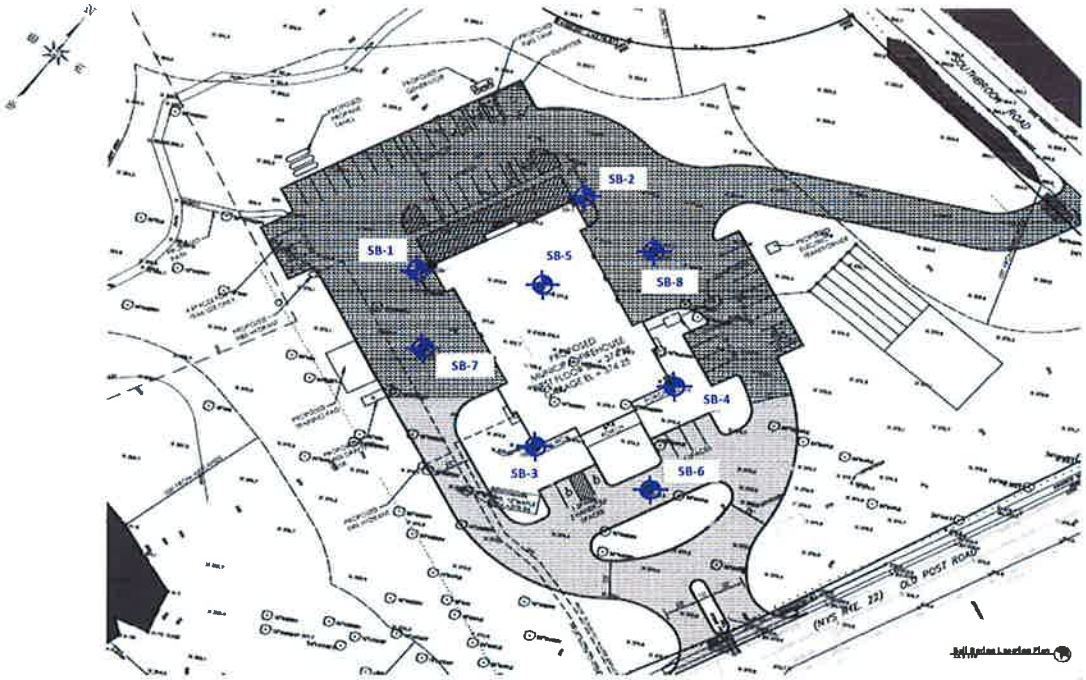
CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-102
Project: Prop New Fire Station, 550 Old Post Rd, Bedford NY		**SHEET NO.:** 2 of 3
Client: Sullivan Architecture		**JOB NUMBER:** 19-160

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
23						
24						
25						
26		**S-8**	7 10		Gr, br $ l, f S	Rec = 11" wet
27			9 12			
28						
29					**Brown, gray SILT little, fine Sand with Clayey Silt layers**	
30						
31		**S-9**	3 4		same	Rec = 12" wet
32			6 6			
33						
34						
35						
36		**S-10**	5 4		same, s f S	Rec = 16" wet
37			7 6			
38						
39						
40						
41		**S-11**	WOH/18		same, Cy $ l, f S	Rec = 20" wet
42			3			
43						
44						
45						
46		**S-12**	2 3		same	Rec = 18" wet
47			3 2			

CARLIN-SIMPSON & ASSOCIATES Sayreville, NJ	TEST BORING LOG	BORING NUMBER B-102
Project:	**Prop New Fire Station, 550 Old Post Rd, Bedford NY**	**SHEET NO.:** 3 of 3
Client:	**Sullivan Architecture**	**JOB NUMBER:** 19-160

Depth (ft.)	Casing Blows per Foot	Sample Number	Blows on Sample Spoon per 6"	Sym	IDENTIFICATION	REMARKS
48						
49						
50					**Gray Clayey SILT little, fine Sand**	
51		**S-13**	WOH 2		Gr Cy $ l, f S	Rec = 15" wet
52			3 6		52'0"	
53					**End of Boring @ 52'0"**	
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						

BORING LOCATION PLAN



LEGEND

SB-1 Designation and approximate location of soil borings

Note:

1. This drawing was based on the project design drawing entitled "Soil Boring Locations", Drawing No. SB-1, prepared by H2M architects + engineers, dated August 2018.

BORING LOCATION PLAN			
JHB Engineering PLLC VISION • MEANS • RESULTS Geotechnical / Civil Engineers 400 Rella Blvd., Suite 165 Montebello, NY 10901 Tel.: (845) 533-0215 WWW.JHBGEO.COM	Project: New Fire Station 550 Old Post Road Bedford, NY 10506		
	DRAWING NO.:	FIGURE	2
	PROJ. NO.: P18.11	DRAWN BY:	JFW
	SCALE: NTS	DATE:	10/31/2018

APPENDIX I – BORING LOGS

PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 2	**BORING No.** B-1	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/26/18 **Date Finished:** 10/26/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 371 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Cloudy

Groundwater Depth (ft): 5.5 **TEMP. (°F):** 43

GWT Measure Date/Time: 10/26/18 @ 11:00AM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 50
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	2	1 1 1 1	14		M	SP			Top 6": Blk f SAND, little Silt, trace f Gravel, trace Organics/Roots Bottom 8": Bwn-Or m-f SAND, trace f Gravel, trace Silt		2	Boring Located 7.4 feet Southwest of SB-1 Stake Marker
	S-2	10	2 4 6 8	10		M	SP			Bwn-Tn c-f SAND, trace Gravel, trace Silt		10	
5	S-3	11	7 5 6 6	14		W	SP SM			Top 8": SAME Bottom 6": Bwn-Gy f SAND, some Silt, mottling		11	
	S-4	10	5 5 5 3	16		W	SP		8.0	SAME	363.0	10	
10	S-5	7	5 4 3 4	18		W	ML			Gy-Bwn Clayey SILT, trace Organics, mottling		7	
	S-6	8	3 4 4 5	12		W	ML		13.5	Gy Clayey SILT	357.5	8	
15	S-7	9	4 4 5 5	14		W	CL			Gy Silty CLAY		9	
20	S-8	11	4 6 5 5	16		W	CL			SAME		11	
25	S-9	10	5 4 6 5	14		W	CL			SAME		10	
30	S-10	8	3 4 4 4	16		W	CL			SAME		8	
35													

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 2 **of** 2

BORING No. B-1

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Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
35	S-11	5	3 2 3 3	12		W	CL			SAME		5	
40	S-12	6	3 3 3 4	18		W	CL			SAME		6	
45	S-13	10	4 5 5 5	14		W	CL			SAME		10	
50	S-14	12	6 6 6 8	16		W	CL		52.0	SAME	319.0	12	

Bottom of borehole at 52.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 3	**BORING No.** B-2	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/24/18 **Date Finished:** 10/24/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 371 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Partly Cloudy

Groundwater Depth (ft): 6 **TEMP. (°F):** 55

GWT Measure Date/Time: 10/24/2018 @ 9:25AM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 80
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	2	1 1 1 2	18		M	SP SP			Top 1": Blk f SAND, trace Silt, trace Organics/Roots Middle 8": Bwn f SAND, trace Silt, trace Organics Bottom 9": Tn-Bwn m-f SAND, trace Silt, trace f Gravel		2	Boring Located 10.95 feet North of SB-2 Stake Marker
	S-2	12	2 6 6 7	5		D	SP			Bwn m-f SAND, trace Silt		12	
5	S-3	11	8 6 5 6	5		M	SP			Tn-Bwn m-f SAND, little c-f Gravel, trace Silt		11	
	S-4	10	5 5 5 6	22		W	SP SP			Tn-Bwn c-f SAND, little f Gravel, trace Silt Tn-Bwn m-f SAND, trace Silt, (micaceous)		10	
10	S-5	8	5 4 4 4	16		W	SP SM			Top 6": SAME Bottom 10": Tn f SAND, little Silt, mottling		8	
	S-6	7	5 4 3 5	22		W	SM			Tn f SAND, little Silt		7	
15	S-7	8	4 4 4 3	16		W	SM			Gy f SAND, little Silt		8	
									18.5		352.5		
20	S-8	13	5 6 7 7	14		W	ML			Gy SILT, trace f Sand		13	PPT: 0.2 tsf
25	S-9	6	1 3 3 3	16		W	MH			Gy Clayey SILT		6	PPT: 0.1 tsf
									28.5		342.5		
30	S-10	8	3 3 5 4	18		W	CL			Gy Silty CLAY		8	PPT: <0.1 tsf
									33.5		337.5		
35													

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 2 **of** 3

BORING No. B-2

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Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
35	S-11	10	5 5 5 5	18		W	ML		Gy Clayey SILT		10	PPT: <0.1 tsf
								38.5		332.5		
40	S-12	14	6 6 8 6	14		W	CL		Gy Silty CLAY		14	PPT: 0.1 tsf
								43.5		327.5		
45	S-13	12	6 5 7 10	16		W	ML		Gy Clayey SILT		12	PPT: 0.2 tsf
								48.5		322.5		
50	S-14	10	5 4 6 5	12		W	CL		Gy Silty CLAY		10	PPT: 0.2 tsf
								53.5		317.5		
55	S-15	11	4 6 5 5	16		W	ML		Gy Clayey SILT		11	PPT: 0.3 tsf
60	S-16	19	11 10 9 11	16		W	ML		Gy Clayey SILT, trace f Sand		19	PPT: 0.35 tsf
								63.5		307.5		
65	S-17	11	6 5 6 6	18		W	CL		Gy Silty CLAY		11	PPT: 0.45 tsf
								68.5		302.5		
70	S-18	23	9 11 12 12	16		W	ML		Gy Clayey SILT, trace f Sand		23	PPT: 0.45 tsf
								73.5		297.5		
75							SP					

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD	BORING No.	JHB ENGINEERING PLLC geotechnical engineers
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506	B-2	www.jhbgeo.com (845) 533-0215
PROJECT NUMBER P18.11 Page 3 of 3		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
	S-19	22	11 11 10	10		W				Gy m-f SAND, little Silt, trace f Gravel *(continued)*		22	PPT: 1.25 tsf
80													
	S-20	48	26 27 21 23	8		W	SP		82.0	Gy m-f SAND, little m-f Gravel, trace Silt	289.0	48	

Bottom of borehole at 82.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506 PROJECT NUMBER P18.11 Page 1 of 3	**BORING No.** B-3	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/24/18 Date Finished: 10/25/18 Inspector: NN Driller: Mike Gorski

Drill Rig Model: CME-55 LC Sampler: 2" O.D. Split Spoon Hammer Wt/Drop: 140lb/30"

Surface EL: 374 ft. Vertical Datum: See Notes Depth to Bedrock (ft): NE

Boring Location: See Boring Location Plan WEATHER: Partly Cloudy

Groundwater Depth (ft): 5.5 TEMP. (°F): 56

GWT Measure Date/Time: 10/24/2018 @ 12:10PM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 75
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	4	1 2 2 1	12		M	SP SP		Top 4": Blk-Bwn m-f SAND, trace Organics/Roots, (micaceous) Bottom 8": Tn-Bwn m-f SAND, (micaceous)		4	Boring Located Directly on SB-3 Staker Marker
	S-2	6	3 3 3 3	18		M	SP		Tn-Bwn m-f SAND, trace Silt		6	
5	S-3	16	4 6 10 13	22		M	SP SP		Top 16": SAME Bottom 6": Bwn c-f SAND, trace f Gravel, (micaceous)		16	
	S-4	30	10 16 14 12	16		W	SP		SAME		30	
10	S-5	24	14 16 8 7	16		W	SP		Bwn c-f SAND, little f Gravel, (micaceous)		24	
	S-6	5	4 2 3 4	18		W	SP ML	10.7	Top 6": SAME Bottom 12": Bwn-Tn Clayey SILT	363.3	5	
15	S-7	11	4 5 6 5	14		W	ML		Gy Clayey SILT		11	
20	S-8	17	5 7 10 10	16		W	ML		SAME		17	
								23.5		350.5		
25	S-9	11	5 6 5 6	14		W	CL		Gy Silty CLAY		11	
30	S-10	11	6 6 5 5	14		W	CL		SAME		11	
35												

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 2 **of** 3

BORING No. B-3

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Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
35													
	S-11	6	4 3 3 4	14		W	CL			SAME		6	
40													
	S-12	6	4 3 3 3	18		W	CL			SAME		6	
45													
	S-13	8	4 3 5 5	18		W	CL			SAME		8	
50													
	S-14	4	4 2 2 4	20		W	CL			SAME		4	
									53.5		320.5		
55													
	S-15	12	6 6 6 8	12		W	ML			Gy Clayey SILT		12	
									58.5		315.5		
60													
	S-16	11	4 5 6 7	18		W	CL SP		61.3	Top 12" : Gy Silty CLAY Bottom 6" : Gy f SAND, little Silt	312.7	11	
65													
	S-17	11	4 5 6 6	12		W	SP			SAME		11	
70													
	S-18	100	17 100/1" - -	6		W	SP			Gy m-f SAND, some c-f Gravel, little Silt, decomposed rock		>>	
									73.5		300.5		
75													

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 3 **of** 3

BORING No. B-3

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Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
	S-19	0	100/3"	3		W	GP		77.0	Wh-Blk c-f GRAVEL (decomposed rock, micaceous) *(continued)*	297.0		

Bottom of borehole at 77.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 2	**BORING No.** B-4	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/29/18 **Date Finished:** 10/29/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 373 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Overcast

Groundwater Depth (ft): 6 **TEMP. (°F):** 49

GWT Measure Date/Time: 10/29/2018 @ 9:15AM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 50
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	2	1 1 1 1	1		M	SM			Blk-Bwn m-f SAND, little Silt, trace Organics/Roots		2	Boring Located 2.1 feet Southwest of SB-4 Stake Marker
	S-2	7	2 3 4 5	12		M	SP SM			Top 4": Tn-Bwn m-f SAND, little Silt, mottling Bottom 8": Bwn c-f SAND, some m-f Gravel, trace Silt		7	
5	S-3	14	7 6 8 7	14		M	SP			Bwn c-f SAND, some m-f Gravel, trace Silt		14	
	S-4	12	6 6 6 7	14		W	SP SM		8.0	Top 4": SAME Bottom 10": Bwn-Tn f SAND, little Silt, trace Organics/Roots	365.0	12	
10	S-5	8	7 4 4 4	14		W	ML		10.0	Gy-Bwn Clayey SILT	363.0	8	
	S-6	8	7 4 4 6	16		W	CL			Gy-Bwn Silty CLAY		8	
15													
	S-7	17	7 8 9 9	16		W	CL			SAME		17	
20													
	S-8	17	8 8 9 9	16		W	CL			SAME		17	
25													
	S-9	14	6 7 7 7	18		W	CL			SAME		14	
30													
	S-10	8	5 5 3 3	20		W	CL			SAME		8	
35													

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 2 **of** 2

BORING No. B-4

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Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
35													
	S-11	8	3 4 4 5	14		W	CL			SAME		8	
40													
	S-12	8	3 5 3 3	18		W	CL			SAME		8	
45													
	S-13	8	3 4 4 4	16		W	CL			SAME		8	
50													
	S-14	9	3 4 5 4	16		W	CL			Top 12": SAME		9	
							ML		51.5		321.5		
									52.0	Bottom 4": Gy Clayey SILT	321.0		

Bottom of borehole at 52.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

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PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 2	**BORING No.** B-5	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/25/18 **Date Finished:** 10/26/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 372 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** 65'

Boring Location: See Boring Location Plan **WEATHER:** Partly Cloudy

Groundwater Depth (ft): 5 **TEMP. (°F):** 50

GWT Measure Date/Time: 10/26/2018 @ 12:15PM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 65
Casing:	4"	0 TO 10
Rock Core:		65 TO 70

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	3	1 2 1 2	8		M	SM			Top 6": Blk-Bwn m-f SAND, little Silt, trace Organics/Roots Bottom 2": Bwn-Or m-f SAND, little Silt		3	Boring Located Directly on SB-5 Stake Marker
	S-2	8	1 2 6 7	20		M	SP SM SP			Top 2": SAME Middle 8": Tn m-f SAND, trace f Gravel, little Silt, (micaceous) Bottom 10": Bwn c-f SAND, little f Gravel, trace Silt, (micaceous)		8	
5	S-3	19	6 9 10 12	14		M	SP SP			Top 2": Tn-Bwn m-f SAND, trace Silt Bottom 12": Bwn c-f SAND, little f Gravel, trace Silt, (micaceous)		19	
	S-4	14	10 8 6 6	16		W	SP SP			Top 6": SAME Bottom 10": Gy-Bwn f SAND, little Silt, mottling		14	
	S-5	11	6 6 5 4	18		W	SM ML		8.7 10.0	Top 6": Bwn c-f SAND, trace f Gravel, little Silt Bottom 12": Bwn-Gy SILT, little f Sand	363.3 362.0	11	
10	S-6	7	6 4 3 3	16		W	CL			Bwn-Gy Silty CLAY		7	
15													
	S-7	11	4 5 6 5	12		W	CL			Gy-Bwn Silty CLAY		11	
20													
	S-8	13	6 7 6 6	14		W	CL			SAME		13	
25													
	S-9	7	7 3 4 4	14		W	CL			SAME		7	
30													
	S-10	8	5 4 4 4	14		W	CL			SAME		8	
35													

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

(Continued Next Page)

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PROJECT NAME New Fire Station - BVFD
PROJECT LOCATION 550 Old Post Road, Bedford, NY, 10506
PROJECT NUMBER P18.11 **Page** 2 **of** 2

BORING No. B-5

JHB ENGINEERING PLLC
geotechnical engineers
www.jhbgeo.com (845) 533-0215

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES (20 40 60)	REMARKS
35													
	S-11	7	4 3 4 3	16		W	CL			SAME		7	
40													
	S-12	6	4 3 3 3	18		W	CL			SAME		6	
45													
	S-13	19	5 7 12 12	16		W	CL			SAME		19	
50													
	S-14	8	6 5 3 4	16		W	CL			SAME		8	
55													
	S-15	19	7 8 11 11	12		W	CL			SAME		19	
60													
	S-16	19	7 9 10 9	14		W	CL			SAME		19	
65									65.0		307.0		Slow Drilling/Rattling @ 64 feet
	S-17	0	50/0"	0								0	Refusal
	C-1	2 4 5 7		56	83.4					Wh and Gy GNEISS, Hard, slightly weathered, moderately fractured with fractures 0 to 40 degrees from horizontal			Rock Coring @ 65 feet to 70 feet
70									70.0		302.0		

Bottom of borehole at 70.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

ENVIRONMENTAL BH - TEMPLATE2.GDT - 11/9/18 11:11 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\P18.11_BEDFORD,NY.GPJ

PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 1	**BORING No.** B-6	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/29/18 **Date Finished:** 10/29/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 375 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Overcast

Groundwater Depth (ft): 6 **TEMP. (°F):** 49

GWT Measure Date/Time: 10/29/2018 @ 8:50AM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 15
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	4	2 2 2 2	16		M	SP SP SP			Top 6": Blk-Bwn m-f SAND, trace roots Middle 4": Or-Tn m-f SAND, trace Silt Bottom 6": Tn m-f SAND, trace Silt, (micaceous)		4	Boring Located Directly on SB-6 Stake Marker
	S-2	6	2 2 4 3	18		M	SP			SAME		6	
5	S-3	15	4 6 9 10	16		M	SP			SAME		15	
	S-4	22	11 11 11 15	16		W	SP SM			Top 4": SAME Bottom 12": Bwn-Tn c-f SAND, some c-f Gravel, little Silt (micaceous)		22	
10	S-5	32	20 16 16 15	14		W	SP			Tn-Bwn c-f SAND, some c-f Gravel, (micaceous)		32	
	S-6	9	11 5 4 4	16		W	SP ML		11.5	Top 12": SAME	363.5	9	
									13.5	Bottom 4": Bwn-Gy Clayey SILT	361.5		
15	S-7	13	3 5 8 5	16		W	CL		17.0	Gy Silty CLAY	358.0	13	

Bottom of borehole at 17.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

ENVIRONMENTAL BH - TEMPLATE2.GDT - 11/9/18 11:11 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\P18.11_BEDFORD,NY.GPJ

PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 1	**BORING No.** B-7	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/26/18 **Date Finished:** 10/26/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 372 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Sunny

Groundwater Depth (ft): 6 **TEMP. (°F):** 47

GWT Measure Date/Time: 10/26/2018 @ 1:00PM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 15
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	2	1 1 1 1	14		M	SM			Top 6": Blk-Bwn m-f SAND, little Silt, trace Organics/Roots Bottom 8": Or-Tn m-f SAND, little Silt, (wood chips)		2	Boring Located Directly on SB-7 Stake Marker
	S-2	6	4 3 3 3	18		M	SM			Bwn-Tn m-f SAND, little Silt, (micaceous)		6	
5	S-3	17	8 7 10 11	16		M	SP SM			Top 4": SAME Bottom 12": Bwn c-f SAND, little c-f Gravel, little Silt ▼		17	
	S-4	16	10 9 7 6	14		W	SP SM			Top 10": SAME Bottom 4": Bwn f SAND, little Silt		16	
	S-5	7	5 4 3 4	16		W	SM ML		8.5	Top 4": Bwn c-f SAND, trace m-f Gravel, little Silt	363.5	7	
10									10.0	Bottom 12": Bwn Clayey SILT	362.0		
	S-6	12	5 5 7 8	22		W	CL			Bwn Silty CLAY		12	
15													
	S-7	11	5 5 6 5	14		W	CL		17.0	SAME	355.0	11	

Bottom of borehole at 17.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

ENVIRONMENTAL BH - TEMPLATE2.GDT - 11/9/18 11:11 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\P18.11_BEDFORD.NY.GPJ

PROJECT NAME New Fire Station - BVFD **PROJECT LOCATION** 550 Old Post Road, Bedford, NY, 10506 **PROJECT NUMBER** P18.11 **Page** 1 **of** 1	**BORING No.** B-8	JHB ENGINEERING PLLC geotechnical engineers www.jhbgeo.com (845) 533-0215

Date Started: 10/29/18 **Date Finished:** 10/29/18 **Inspector:** NN **Driller:** Mike Gorski

Drill Rig Model: CME-55 LC **Sampler:** 2" O.D. Split Spoon **Hammer Wt/Drop:** 140lb/30"

Surface EL: 371 ft. **Vertical Datum:** See Notes **Depth to Bedrock (ft):** NE

Boring Location: See Boring Location Plan **WEATHER:** Overcast

Groundwater Depth (ft): 4 **TEMP. (°F):** 49

GWT Measure Date/Time: 10/29/2018 @ 7:45AM

DRILLING METHOD	DIA.	DEPTH (ft.)
Power Auger:		
Mud Rotary:	3.875"	0 TO 15
Casing:	4"	0 TO 10
Rock Core:		

Depth (ft.)	Type-Number	N-Value or Min/FT	Pen. Resist (Blows/6 in)	Recovery (in.)	RQD (%)	Moisture	USCS Symbol	GRAPHIC SYMBOL	Depth (ft.)	MATERIAL DESCRIPTION (strata changes are inferred)	Elevation (ft.)	N-VALUES	REMARKS
0	S-1	3	1 1 2 3	10		M	SM SP			Top 6": Blk-Bwn m-f SAND, little Silt, trace Organics/Roots Bottom 4": Bwn-Or m-f SAND, some c-f Gravel, trace Silt		3	Boring Located Directly on SB-8 Stake Marker
	S-2	8	4 4 4 5	18		M	SP			Tn-Bwn m-f SAND, trace Silt, (micaceous)		8	
5	S-3	10	3 4 6 4	16		W	SP			SAME		10	
	S-4	7	5 4 3 3	22		W	SP			SAME		7	
	S-5	9	3 4 5 4	18		W	SP		9.3	Top 12": SAME	361.7	9	
10							ML		10.0	Bottom 6": Bwn-Gy Clayey SILT, mottling	361.0		
	S-6	8	5 4 4 4	14		W	CL			Gy-Bwn Silty CLAY		8	
15													
	S-7	6	2 3 3 5	16		W	CL		17.0	SAME	354.0	6	

Bottom of borehole at 17.0 feet.

Notes: Surface elevation was estimated based on a drawing entitled "Soil Boring Locations", Drawing No. SB-1, dated August 2018, prepared by H2M architects + engineers

ENVIRONMENTAL BH - TEMPLATE2.GDT - 11/9/18 11:11 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\P18.11_BEDFORD,NY.GPJ

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

SITEWORK CONSTRUCTION CONTRACTOR – Contract # 1

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Sitework Construction Work of this Project, including the availability of materials and labor, and fully understanding the requirements of the Bidding and Contract Documents for the above mentioned Project, we, the Undersigned Contractor, hereby offer to enter into a Contract to furnish all labor, supervision, materials, tools, equipment, transportation, and services necessary to perform and complete the Sitework Construction Work of the Project in strict accordance with the Contract Documents within the time limit, and that if this Bid is accepted, the Undersigned agrees to enter into the Contract with the Owner to perform and complete this Work for the Sum of:

BASE BID (includes allowances per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America (herein referred to as the Base Bid).

We have included the Security Bid Bond as required by the Instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this Project. In computing its Bid, the Undersigned Contractor shall not include the sales and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Undersigned Contractor for and on behalf of the Owner when such supplier or materials are incorporated in and become a part of the completed improvement. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

None

1.3 UNIT PRICES

The undersigned agrees, if awarded the Contract, to perform work "in addition to," or "delete work from" the scope of the Contract Documents as directed by the Owner and/or Architect, computed in accordance with the unit prices herein after listed.

Unit prices shall be the total compensation for the item and include all overhead, profit, and any other charges of the Contractor and/or its subcontractors in connection therewith.

Adjustments will be computed on net variation of total quantities of like items.

The Owner reserves the right to accept or reject any and/or all of the unit prices listed below prior to the execution of the Contract.

Item No.	Schedule Item	Measurement	Unit Price
1.	SC-1 Removal & Replacement of Unsuitable soil and replace with imported structural fill	Per cubic yard	$_____

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. Allowance SC-1: Contractor shall include a contingency allowance of $75,000.00 for use according to the Owner's Instructions.

b. Allowance SC-2: Unsuitable Soil: Contractor shall include in their base bid a quantity allowance of 150 cy for removal of unsuitable soil material and

replacement with compacted engineered structural fill.

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we shall

- Execute the Agreement within ten (10) days of receipt of Notice of Award.
- Furnish the required bonds within ten (10) days of receipt of Notice of Award.
- Commence Work within seven (7) days after written Notice to Proceed in the form described in the Contract Documents.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the Undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Sitework Construction of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this Project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this Bid will be permitted after the time specified for the receipt of Bids except in strict accordance with the Bidding Documents and applicable law.

The Undersigned has examined the location of the proposed Sitework Construction Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where said Work is to be performed, including, without limitation, the Center for Disease Control (CDC) guidelines, NYS Governor's Executive Order

202.34, NYS Interim Guidance for Construction Activities during the COVID-19 Public Health Emergency and any other federal, state or local requirements and guidelines related to the COVID-19 pandemic. Refer to the General Conditions of the Contract for Construction for additional requirements.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Base Bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES
The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer
Title)
(Seal)

_____
(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

GENERAL CONSTRUCTION CONTRACTOR – Contract # 2

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Work of this Project, including the availability of materials and labor, and all matters referred to in the Instructions to Bidders and the Contract Documents for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to furnish all labor, materials, equipment, transportation, and services necessary to perform and complete the construction of the Project in accordance with the Contract Documents within the time limit, for the Sum of:

BASE BID (includes allowances per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America.

We have included the Security Bid Bond as required by the instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this project. In computing their bids, contractors shall not include the sales

and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Contractor for and on behalf of the Owner. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

Bidders are required to Bid on all alternates within the Bidding Documents. Bidders shall set forth in the space provided, therefore, the amount to be added to or deducted from the Base Bid. if the Bidder does not desire to make a change from the Base Bid, he shall so indicate by using the words "No Change."

a) ADD Alternate GC-1:

1) Indicate the amount to be added to the Base Bid for all general work associated with the 2nd Floor Interiors Area as shown on the Contract Documents, if added to the Contract.

ADD: _____ _____
TOTAL FOR MATERIALS & LABOR (written) (figures)

b) DEDUCT Alternate GC-2:

1) Indicate the amount to be deducted from the Base Bid for all general work associated with Section 10 51 13 - Metal Lockers (Wardrobe, lockers, Gear lockers and Locker benches) as shown on the Contract Documents, if removed from the Contract.

DEDUCT: _____ _____
TOTAL FOR MATERIALS & LABOR (written) (figures)

1.3 UNIT PRICES

The undersigned agrees, if awarded the contract, to perform work "in addition to," or "delete work from" the scope of the contract documents as directed by the owner and/or architect, computed in accordance with the unit prices herein after listed.

Unit prices shall be the total compensation for the item and include all overhead, profit, and any other charges of the contractor and/or subcontractor in connection therewith.

Adjustments will be computed on net variation of total quantities of like items.

The owner reserves the right to accept or reject any and/or all of the unit prices listed below prior to the execution of the contract.

Item No.	Schedule Item	Measurement	Unit Price

1.	GC-1 Removal & Replacement of Unsuitable soil and replace with imported structural fill	Per cubic yard	$_____

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. **Allowance GC-1: Contractor shall include a contingency allowance of $125,000.00 for use according to the Owner's Instructions.**

b. **Allowance GC-2: Unsuitable Soil: Contractor shall include in their base bid an allowance of 150 cy for removal of unsuitable soil material and replacement with compacted engineered structural fill.**

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we will

- Execute the Agreement within seven (7) days of receipt of Notice to Proceed.
- Furnish the required bonds within seven (7) days of receipt of Notice to Proceed in the form described in Contract Documents.
- Commence Work within seven (7) days after written Notice to Proceed.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as

higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this proposal will be permitted after the time specified for the receipt of Bids.

The Undersigned has examined the location of the proposed Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where Work is to be performed.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item per SED Project Number, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within Thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____

(Authorized signing officer
Title)
(Seal)

_____

(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

MECHANICAL CONSTRUCTION CONTRACTOR – Contract # 3

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Mechanical Construction Work of this Project, including the availability of materials and labor, and fully understanding the requirements of the Bidding and Contract Documents for the above mentioned Project, we, the Undersigned Contractor, hereby offer to enter into a Contract to furnish all labor, supervision, materials, equipment, tools, transportation, and services necessary to perform and complete the Mechanical Construction Work of the Project in strict accordance with the Contract Documents within the time limit, and that if this Bid is accepted, the Undersigned agrees to enter into the Contract with the Owner to perform and complete this Work for the Sum of:

BASE BID (includes allowance per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America (herein referred to as the Base Bid).

We have included the Security Bid Bond as required by the Instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this project. In computing its Bid, the Undersigned Contractor shall not include the sales and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Undersigned Contractor for and on behalf of the Owner when such supplier or materials are incorporated in and become a part of the completed improvement. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

Bidders are required to Bid on all alternates within the Bidding Documents. Bidders shall set forth in the space provided, therefore, the amount to be added to or deducted from the Base Bid. Include in the amount of each Alternate, all labor, materials, overhead and profit, modification of Work specified in the Contract Documents, and additional work that may be required by acceptance of the Alternate. If the Bidder does not desire to make a change from the Base Bid, he shall so indicate by using the words "No Change." See Division 01 ALTERNATES for additional information.

a) ADD Alternate MC-1:

1) Indicate the amount to be added to the Base Bid for all mechanical work associated with the 2nd Floor Interiors Area as shown on the Contract Documents, if added to the Contract.

ADD: _____ _____

TOTAL FOR MATERIALS & LABOR (written) (figures)

1.3 UNIT PRICES – None

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. **Allowance MC-1: Contractor shall include a contingency allowance of $45,000.00 for use according to the Owner's Instructions.**

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we shall

- Execute the Agreement within ten (10) days of receipt of Notice of Award.
- Furnish the required bonds within ten (10) days of receipt of Notice of Award.
- Commence Work within seven (7) days after written Notice to Proceed in the form described in the Contract Documents.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the Undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Mechanical Construction Work of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this Project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this Bid will be permitted after the time specified for the receipt of Bids except in strict accordance with the Bidding Documents and applicable law.

The Undersigned has examined the location of the proposed Mechanical Construction Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where said Work is to be performed, including, without limitation, the Center for Disease Control (CDC) guidelines, NYS Governor's Executive Order 202.34, NYS Interim Guidance for Construction Activities during the COVID-19 Public

Health Emergency and any other federal, state or local requirements and guidelines related to the COVID-19 pandemic. Refer to the General Conditions of the Contract for Construction for additional requirements.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within Thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Base Bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer
Title)
(Seal)

_____
(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

ELECTRICAL CONSTRUCTION CONTRACTOR – Contract # 4

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Electrical Construction Work of this Project, including the availability of materials and labor, and fully understanding the requirements of the Bidding and Contract Documents for the above mentioned Project, the Undersigned Contractor hereby offers to furnish all labor, supervision, materials, tools, equipment, transportation, and services necessary to perform and complete the Electrical Construction Work of the Project in strict accordance with the Contract Documents within the time limit, and that if this Bid is accepted, the Undersigned agrees to enter into the Contract with the Owner to perform and complete this Work for the Sum of:

BASE BID (includes allowances per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America (herein referred to as the Base Bid).

We have included the Security Bid Bond as required by the Instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this Project. In computing its Bid, the Undersigned Contractor shall not include the sales and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Undersigned Contractor for and on behalf of the Owner when such supplier or materials are incorporated in and become a part of the completed improvement. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

Bidders are required to Bid on all alternates within the Bidding Documents. Bidders shall set forth in the space provided, therefore, the amount to be added to or deducted from the Base Bid. Include in the amount of each Alternate, all labor, materials, overhead and profit, modification of Work specified in the Contract Documents, and additional work that may be required by acceptance of the Alternate. If the Bidder does not desire to make a change from the Base Bid, he shall so indicate by using the words "No Change." See Division 01 ALTERNATES for additional information.

a) ADD Alternate EC-1:
   1) Indicate the amount to be added to the Base Bid for all electrical work associated with the 2nd Floor Interiors Area as shown on the Contract Documents, if added to the Contract.

      ADD: _____ _____
      TOTAL FOR MATERIALS & LABOR (written) (figures)

b) DEDUCT Alternate EC-2:
   1) Indicate the amount to be deducted from the Base Bid for all electrical work associated with connections for the Gear Lockers as shown on the Contract Documents, if removed from the Contract.

      DEDUCT: _____ _____
      TOTAL FOR MATERIALS & LABOR (written) (figures)

1.3 UNIT PRICES – None

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. **Allowance EC-1: Contractor shall include a contingency allowance of $45,000.00 for use according to the Owner's Instructions.**

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we shall

- Execute the Agreement within ten (10) days of receipt of Notice of Award.
- Furnish the required bonds within ten (10) days of receipt of Notice of Award.
- Commence Work within seven (7) days after written Notice to Proceed in the form described in the Contract Documents.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the Undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Electrical Construction Work of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this Project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this Bid will be permitted after the time specified for the receipt of Bids except in strict accordance with the Bidding Documents and applicable law.

The Undersigned has examined the location of the proposed Electrical Construction Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where said Work is to be performed, including, without limitation,

the Center for Disease Control (CDC) guidelines, NYS Governor's Executive Order 202.34, NYS Interim Guidance for Construction Activities during the COVID-19 Public Health Emergency and any other federal, state or local requirements and guidelines related to the COVID-19 pandemic. Refer to the General Conditions of the Contract for Construction for additional requirements.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Base Bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer
Title)
(Seal)

_____
(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

PLUMBING CONSTRUCTION CONTRACTOR – Contract # 5

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Plumbing Construction Work of this Project, including the availability of materials and labor, fully understanding the requirements of the Bidding and Contract Documents for the above mentioned Project, we, the Undersigned Contractor, hereby offer to enter into a Contract to furnish all labor, supervision, materials, equipment, tools, transportation, and services necessary to perform and complete the Plumbing Construction Work of the Project in strict accordance with the Contract Documents within the time limit, and that if this Bid is accepted, the Undersigned agrees to enter into the Contract with the Owner to perform and complete this Work for the Sum of:

BASE BID (includes allowance per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America (herein referred to as the Base Bid).

We have included the Security Bid Bond as required by the instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this project. In computing its Bid, the Undersigned Contractor shall not include the sales and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Undersigned Contractor for and on behalf of the Owner when such supplier or materials are incorporated in and become a part completed improvement. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

Bidders are required to Bid on all alternates within the Bidding Documents. Bidders shall set forth in the space provided, therefore, the amount to be added to or deducted from the Base Bid. Include in the amount of each Alternate, all labor, materials, overhead and profit, modification of Work specified in the Contract Documents, and additional work that may be required by acceptance of the Alternate. If the Bidder does not desire to make a change from the Base Bid, he shall so indicate by using the words "No Change." See Division 01 ALTERNATES for additional information.

a) ADD Alternate PC-1:

1) Indicate the amount to be added to the Base Bid for all plumbing work associated with the 2nd Floor Interiors Area as shown on the Contract Documents, if added to the Contract.

ADD: _____ _____
TOTAL FOR MATERIALS & LABOR (written) (figures)

1.3 UNIT PRICES – None

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. Allowance PC-1: Contractor shall include a contingency allowance of $30,000.00 for use according to the Owner's Instructions.

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we shall

- Execute the Agreement within ten (10) days of receipt of Notice of Award.
- Furnish the required bonds within ten (10) days of receipt of Notice of Award.
- Commence Work within seven (7) days after written Notice to Proceed in the form described in the Contract Documents.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the Undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Plumbing Construction Work of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this Project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this Bid will be permitted after the time specified for the receipt of Bids except in strict accordance with the Bidding Documents and applicable law.

The Undersigned has examined the location of the proposed Plumbing Construction Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where said Work is to be performed, including, without limitation, the Center for Disease Control (CDC) guidelines, NYS Governor's Executive Order 202.34, NYS Interim Guidance for Construction Activities during the COVID-19 Public Health Emergency and any other federal, state or local requirements and guidelines related to the COVID-19 pandemic. Refer to the General Conditions of the Contract for Construction for additional requirements.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Base Bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer
Title)
(Seal)

_____
(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SECTION 00 41 16 – BID FORM – (MULTIPLE-PRIME CONTRACT)

FIRE PROTECTION CONSTRUCTION CONTRACTOR – Contract # 6

To: Bedford Village Fire District
34 Village Green
Bedford, NY 10506

Project: Bedford Fire Headquarters Project

Date: _____

Submitted by: _____
(full name
and address) _____

_____

Telephone No. _____

1.1 OFFER

Having examined the Place of The Work and having familiarized himself with the local conditions and any other conditions affecting the Fire Protection Construction Work of this Project, including the availability of materials and labor, and fully understanding the requirements of the Bidding and Contract Documents for the above mentioned Project, we, the Undersigned Contractor, hereby offer to enter into a Contract to furnish all labor, supervision, materials, equipment, tools, transportation, and services necessary to perform and complete the Fire Protection Construction Work of the Project in strict accordance with the Contract Documents within the time limit, and that if this Bid is accepted, the Undersigned agrees to enter into the Contract with the Owner to perform and complete this Work for the Sum of:

BASE BID (includes allowance per Section 01 21 00)

$_____
(figures)

_____ dollars,
(written)

in lawful money of the United States of America (herein referred to as the Base Bid).

We have included the Security Bid Bond as required by the Instruction to Bidders.

The Owner is exempt from paying State and Local sales taxes on any materials which it purchases for this Project. In computing its Bids, the Undersigned Contractor shall not include the sales and compensating use taxes of the State of New York or of any City and County in the State of New York for any supplies or materials to be used by the Undersigned Contractor for and on behalf of the Owner when such supplier or materials are incorporated in and become a part of the completed improvement. It shall be the Contractor's responsibility to secure the State of New York Dept. of Taxation ST 120-1, Contractor's Exemption Purchase Certificate and to comply with all instructions of this form.

1.2 ALTERNATES

Bidders are required to Bid on all alternates within the Bidding Documents. Bidders shall set forth in the space provided, therefore, the amount to be added to or deducted from the Base Bid. Include in the amount of each Alternate, all labor, materials, overhead and profit, modification of Work specified in the Contract Documents, and additional work that may be required by acceptance of the Alternate. If the Bidder does not desire to make a change from the Base Bid, he shall so indicate by using the words "No Change." See Division 01 ALTERNATES for additional information.

a) ADD Alternate FPC-1:

1) Indicate the amount to be added to the Base Bid for all fire protection work associated with the 2nd Floor Interiors Area as shown on the Contract Documents, if added to the Contract.

ADD: _____ _____

TOTAL FOR MATERIALS & LABOR (written) (figures)

1.3 UNIT PRICES – None

1.4 ALLOWANCES

The Bidder hereby certifies that the Base Bid includes the following cash allowances as stipulated by the Architect in the Specifications.

a. Allowance FPC-1: Contractor shall include a contingency allowance of $20,000.00 for use according to the Owner's Instructions.

1.5 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for forty-five (45) calendar days from the Bid closing date. Contract Award shall be determined by the Lowest Responsible Base Bid plus any combination of Alternates at the discretion of the Owner.

If this Bid is accepted by the Owner within the time period stated above, we shall

- Execute the Agreement within ten (10) days of receipt of Notice of Award.
- Furnish the required bonds within ten (10) days of receipt of Notice of Award.
- Commence Work within seven (7) days after written Notice to Proceed in the form described in the Contract Documents.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the Bid security shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the Bid security or the difference between this Bid and the Bid upon which a Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit will be returned to the Undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

The sum given in the Base Bid represents the entire cost of the Fire Protection Construction Work of the Project. The sum given shall include any and all cost for insurance, including all insurance required by the Agreement, any and all fees for licenses and permits. The Undersigned agrees that no claim will be made for any additional costs regardless of any increases in costs such as higher wage scales or material prices. No amount is included in the Base Bid for State and Local sales taxes on any materials which it purchases for this Project.

The Undersigned has carefully checked all the figures used in compiling the sum given in the Base Bid and understands that the Owner will not be responsible for any errors or omissions incurred by the Undersigned in making up of this Bid. The Undersigned further understands that no modification or withdrawal of this Bid will be permitted after the time specified for the receipt of Bids except in strict accordance with the Bidding Documents and applicable law.

The Undersigned has examined the location of the proposed Fire Protection Construction Work, Drawings, Specifications and other Contract Documents and is familiar with local conditions at the place where said Work is to be performed, including, without limitation, the Center for Disease Control (CDC) guidelines, NYS Governor's Executive Order 202.34, NYS Interim Guidance for Construction Activities during the COVID-19 Public Health Emergency and any other federal, state or local requirements and guidelines related to the COVID-19 pandemic. Refer to the General Conditions of the Contract for Construction for additional requirements.

The Undersigned agrees to provide to the Owner with a detailed square foot cost (material and labor) breakdown of each item, prior to award of Contract.

1.6 CONTRACT TIME

If this Bid is accepted, we will

- Substantially Complete the Work as noted in Milestone Schedule. Final Completion shall be within thirty (30) days from Substantial Completion.

1.7 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Base Bid sum.

Addendum #1 Dated _____
Addendum #2 Dated _____
Addendum #3 Dated _____
Addendum #4 Dated _____
Addendum #5 Dated _____

1.8 BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder – print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer
Title)
(Seal)

_____
(Authorized signing officer
Title)
(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

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

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

OWNER:
(Name, legal status and address)

BOND AMOUNT:

PROJECT:
(Name, location or address, and Project number, if any)

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of

(Witness)	*(Contractor as Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

Init.

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ACD43070810

Sample

SECTION 00 45 03 – INSURANCE CERTIFICATION FORM

Name of Project: Bedford Village Fire District Headquarters Project

Your insurance representative must complete the form below in order to be considered for the award of this bid or project, and it is important that you complete the Bidder's Acknowledgement section of this form. **Please note that this Insurance Certification form must accompany your bid submission in order for your bid to be considered.**

Insurance Representative's Acknowledgement:
We have reviewed the insurance requirements set forth in Article 11 of the General Conditions of the Contract for Construction (AIA A232-2019) and are capable of providing such insurance to our insured in accordance with such requirements in the event the contract is awarded to our insured and provided our insured pays the appropriate premium.

Insurance Representative:

_____

Address:

_____

_____

Are you an agent for the companies providing the coverage? Yes_____No_____

Date:_____ _____
Insurance Representative Signature

Bidder's Acknowledgement:

I acknowledge that I have received the insurance requirements of this bid and have considered the costs, if any, of procuring the required insurance and will be able to supply the insurance required in accordance with the bid, if it is awarded. I understand that this Insurance Certification form must be submitted with my bid and my inability to provide the required insurances may result in the rejection of my bid, and the Bedford Village Fire District may award the contract to the next lowest/responsive bidder.

Firm name: _____

Address: _____

_____

Date: _____ _____
Bidder's Signature

AIA® Document A305™ – 1986

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:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

- ☐ Corporation
- ☐ Partnership
- ☐ Individual
- ☐ Joint Venture
- ☐ Other

NAME OF PROJECT: *(If applicable)*

TYPE OF WORK: *(File a separate form for each Classification of Work.)*

- ☐ General Construction
- ☐ HVAC
- ☐ Electrical
- ☐ Plumbing
- ☐ Other: *(Specify)*

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

Sample

§ 1.0 ORGANIZATION

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

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030410

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

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

§ 1.3.4 Vice-president's name(s):

§ 1.3.5 Secretary's name:

§ 1.3.6 Treasurer's name:

§ 1.4 If your organization is a partnership, answer the following:

§ 1.4.1 Date of organization:

§ 1.4.2 Type of partnership, if applicable:

§ 1.4.3 Name(s) of general partner(s):

§ 1.5 If your organization is individually owned, answer the following:

§ 1.5.1 Date of organization:

§ 1.5.2 Name of owner:

Sample

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

§ 2.0 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.

§ 3.0 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, attach details.)

§ 3.2.1 Has your organization ever failed to complete any work awarded to it?

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

§ 3.2.3 Has your organization filed any law suits 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, 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:

Sample

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§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 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 your organization.

§ 4.0 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:

§ 5.0 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:

- **.1** Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);
- **.2** Net Fixed Assets;
- **.3** Other Assets;
- **.4** Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes); and
- **.5** Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

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Sample

§ 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-subsidiary).

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

§ 6.0 SIGNATURE

§ 6.1 Dated this day of 20

Name of organization:

By:

Title:

§ 6.2

M 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:

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

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Sample

SECTION 00 45 19 – NON-COLLUSIVE AFFIDAVIT

Firm Name _____

Business Address _____

Telephone Number _____ Date of Bid _____

I. General Bid Certification

The bidder certifies that he will furnish, at the prices quoted, the materials, equipment, and/or services as proposed on this Bid.

II. Non-Collusive Bidding Certification

The following statement is made pursuant to Section 103-D of the General Municipal Law, as amended by Chapter 675 of the Laws of 1966, and Section 139-D of the State Finance Law, as amended by Chapter 675 of the Laws of 1966, and Section 2604 of the Public Authorities Law, as amended by Chapter 675 of the Laws of 1966.

By submission of this bid proposal, the bidder certifies that he/she is complying with Section 103-D of the General Municipal Law as follows:

Statement of non-collusion in bids and proposals to political subdivision of the state. Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation, or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

Non-collusive bidding certification.

(a) "By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,
3. No attempt has been made or will be made by the bidder to induce any other

person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided, however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the reasons thereof. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department agency or official thereof to which the bid is made or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

(c) Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certifications referred to in subdivision II of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing, and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of corporation.

(d) The person signing this Bid or Proposal certifies that he has fully informed himself/herself regarding the accuracy of the statements contained in this certification, **and under the penalties of perjury**, affirms the truth thereof, such penalties being applicable to the Bidder as well to the person signing in his/her behalf."

Signature of Bidder: _____
(Signature of bidder or authorized representative of a corporation)

Title: _____

Sworn to before me this _____ day of _____ 20_____

_____

SECTION 00 45 20 – CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

As a result of the Iran Divestment Act of 2012 (the "Act"), Chapter 1 of the 2012 Laws of New York, a new provision has been added to State Finance Law (SFL) § 165-a and New York General Municipal Law § 103-g, both effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list of "persons" who are engaged in "investment activities in Iran" (both are defined terms in the law) (the "Prohibited Entities List"). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act's effective date at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, each Bidder/Contractor, any person signing on behalf of any Bidder/Contractor and any assignee or subcontractor and, in the case of a joint bid, each party thereto, certifies, under penalty of perjury, that once the Prohibited Entities List is posted on the OGS website, that to the best of its knowledge and belief, that each Bidder/Contractor and any subcontractor or assignee is not identified on the Prohibited Entities List created pursuant to SFL § 165-a(3)(b).

Additionally, Bidder/Contractor is advised that once the Prohibited Entities List is posted on the OGS Website, any Bidder/Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to this solicitation must certify at the time the Contract is renewed, extended or assigned that it is not included on the Prohibited Entities List.

During the term of the Contract, should the District receive information that a Bidder/Contractor is in violation of the above-referenced certification, the District will offer the person or entity an opportunity to respond. If the person or entity fails to demonstrate that he/she/it has ceased engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then the District shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages or declaring the Bidder/Contractor in default. The District reserves the right to reject any bid or request for assignment for a Bidder/Contractor that appears on the Prohibited Entities List prior to the award of a contract and to pursue a responsibility review with respect to any Bidder/Contractor that is awarded a contract and subsequently appears on the Prohibited Entities List.

I, _____, being duly sworn, deposes and says that he/she is the _____ of the _____Corporation and that neither the Bidder/Contractor nor any proposed subcontractor is identified on the Prohibited Entities List.

_____
SIGNED

SWORN to before me this

_____ day of _____

20___

Notary Public: _____

SECTION 00 45 21 – DECLARATION OF BIDDER'S INABILITY TO PROVIDE CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

Bidders shall complete this form if they cannot certify that the bidder/contractor or any proposed subcontractor is not identified on the Prohibited Entities List. The District reserves the right to undertake any investigation into the information provided herein or to request additional information from the bidder.

Name of the Bidder: _____

Address of Bidder: _____

Has bidder been involved in investment activities in Iran? _____
Describe the type of activities including but not limited to the amounts and the nature of the investments (e.g. banking, energy, real estate)

_____
_____
_____

If so, when did the first investment activity occur? _____

Have the investment activities ended? _____
If so, what was the date of the last investment activity? _____
If not, have the investment activities increased or expanded since April 12, 2012? _____

Has the bidder adopted, publicized, or implemented a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran? _____
If so, provide the date of the adoption of the plan by the bidder and proof of the adopted resolution, if any, and a copy of the formal plan. _____

In detail, state the reasons why the bidder cannot provide the Certification of Compliance with the Iran Divestment Act below (additional pages may be attached):

_____
_____
_____

I, _____, being duly sworn, deposes and says that he/she is the _____ of the _____Corporation and the foregoing is true and accurate.

_____
SIGNED

SWORN to before me this
_____ day of _____

20___

Notary Public: _____

SECTION 00 45 22 - SEXUALHARASSMENT PREVENTION CERTIFICATION FORM

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

Bidder Name: _____

Bidder Address: _____

Signature: _____

Print Name and Title: _____

Date: _____

AIA® Document A132™ – 2019

Standard Form of Agreement Between Owner and Contractor, *Construction Manager as Adviser Edition*

AGREEMENT made as of the _____ day of _____ in the year Two Thousand Twenty-One
(In words, indicate day, month, and year.)

BETWEEN the Owner:
(Name, legal status, address, and other information)

Bedford Village Fire District
34 Village Green
Bedford, NY 10506

and the Contractor:
(Name, legal status, address, and other information)

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

Bedford Fire Headquarters
550 Old Post Road
Bedford, NY 10506

The Construction Manager:
(Name, legal status, address, and other information)

Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

The Architect:
(Name, legal status, address, and other information)

Architectural and Structural Engineering
PC Studio Architect, PLLC
1511 Route 22, Suite C-23
Brewster, NY 10509

Civil Engineering
Kellard Sessions
500 Main Street
Armonk, NY 10504

Mechanical and Electrical Engineering
OLA Consulting Engineers
50 Broadway
Hawthorne, NY 10532

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

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

This document is intended to be used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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The Owner and Contractor agree as follows.

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(Paragraphs deleted)

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, the Bidding Documents, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contractor represents that it has fully reviewed the Contract Documents and agrees that the Contract Documents describe, to the best of the Contractor's knowledge, the Work necessary to furnish and provide and that the Contractor shall furnish and provide a fully functioning Project consistent with the Contract Documents.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. It is the intent of the parties to include within the Work any and all labor, materials, equipment and services that, although not expressly indicated in the Contract Documents, are reasonably inferable therefrom to construct complete and workable systems for the satisfactory performance, execution, final completion and use of the Work and Project.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[X] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work. The provisions of this Contract relating to the time for performance and completion of the Work are of the essence of this Contract. Accordingly, time is of the essence respecting the Contract Documents and all obligations thereunder.

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§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be:
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

Refer to Section 01 11 00 – Milestone Schedule

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of all of the Contractors for the Project are to be completed prior to Substantial Completion of the entire Work of all of the Contractors for the Project, the Contractors shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
Refer to Section 01 11 00 – Milestone Schedule	

§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete

§ 3.4.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall substantially complete the entire Work of this Contract:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[X] By the following date: in accordance with the Section 01 11 00 – Milestone Schedule set forth in the Project Manual

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

Portion of Work	Date to be substantially complete
Refer to Section 01 11 00 – Milestone Schedule	

§ 3.4.3 Time is of the essence in the performance of the Contract Documents, including, without limitation, the Substantial Completion dates established herein. The Contractor shall proceed expeditiously with adequate forces and shall use its best efforts to keep its Work and the Project on schedule, and the Contractor shall achieve the completion times established within the Contract Documents. Milestone dates set forth in the Milestone Schedule are dates critical to the Owner's operations that establish when the Work or a part thereof is to commence and be complete. All milestone dates are of the essence and shall have the same meaning as Substantial Completion or final completion for the purposes of liquidated damages.

§ 3.4.4 If the Contractor fails to substantially and finally complete the Work of this Contract, or portions thereof, as provided in this Section 3.4, liquidated damages shall be assessed as set forth in Section 4.3 herein and Section 8.2.5 of the AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[X] Stipulated Sum, in accordance with Section 4.2 below

[ ] Cost of the Work plus the Contractor's Fee, in accordance with Section 4.3 below

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[ ] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below.)

§ 4.2 Stipulated Sum

§ 4.2.1 The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents. See Contractor's Bid Form, which is attached hereto as **Exhibit A**.

§ 4.2.2 Alternates

§ 4.2.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.2.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.2.4 Unit prices, if any:
(Identify the item and state the unit price, and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.3 Liquidated Damages. Liquidated damages as used and defined in Section 8.2.5 of the AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified, and herein, shall be One Thousand Dollars ($1,000) per calendar day for each day the Project, or a specific Work item, is not substantially complete after expiration of the Contract Time for Substantial Completion, and One Thousand Dollars ($1,000) per calendar day for each day the Project is not finally complete after the expiration of the Contract Time for final completion

(Paragraphs deleted)
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(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and upon certification of the Project Application and Project Certificate for Payment or Application for Payment and Certificate for Payment by the Construction Manager and Architect and issuance by the Architect, the Owner shall make progress

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payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents. Refer to Section 01 29 00 – Payment & Modification Procedures.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 Provided that an acceptable Application for Payment, including all required lien waivers and certified payroll, is received by the Construction Manager not later than the twenty-first day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the thirtieth day of the next month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment of the amount certified shall be made by the Owner not later than 60 days after the Construction Manager receives the Application for Payment.

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.4.2 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

§ 5.1.4.3 In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.4.3.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.4.3.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019, as modified;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Owner, Construction Manager or Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019, as modified; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

(Paragraphs deleted)

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Five percent (5%)

§ 5.1.7.1.1 The following items are not subject to retainage:

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(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

None.

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to when the entire Work of this Contract is substantially complete, including modifications for completion of portions of the Work as provided in Section 3.4.2, insert provisions for such modifications.)

No retainage reduction prior to final completion of the entire Work.

(Paragraphs deleted)
§ 5.2 Final Payment
§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum
§ 5.2.1.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232–2019, as modified, and to satisfy other requirements, if any, which extend beyond final payment;
.2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect; and
.3 the Contractor has fully performed and complied with the final payment and closeout provisions of Specifications.

§ 5.2.1.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment.

(Paragraphs deleted)
§ 5.3 Payments due and unpaid under the Contract shall bear interest from the date payment is due
(Paragraphs deleted)
in accordance with Section 106-b(1)(b) of the New York State General Municipal Law.

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
The Architect will serve as Initial Decision Maker pursuant to Article 15 of AIA Document A232–2019,
(Paragraphs deleted)
as modified.

§ 6.2 Binding Dispute Resolution
For any Claim, dispute or other matter in controversy arising out of or related to the Contract, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Article 15 of AIA Document A232–2019.

[**X**] Litigation in a court of competent jurisdiction located in Westchester County.

[ ] Other: *(Specify)*
(Paragraphs deleted)

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 Where the Contract Sum is a Stipulated Sum
§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019, as modified.

(Paragraphs deleted)
§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019, as modified.

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(Paragraphs deleted)

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019, as modified, or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Keith Branche, Commissioner
Bedford Village Fire District
34 Village Green
Bedford, NY 10506

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in Article 11 of AIA Document A232–2019, as modified, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11 of AIA Document A232–2019, as modified, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232–2019, as modified, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they will endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

§ 8.7 Intentionally omitted.

§ 8.8 Other provisions:

§ 8.8.1 The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

.1 that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;

.2 that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;

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.3 that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;

.4 that its execution of this Agreement and its performance thereof is within its duly authorized powers;

.5 that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contact Documents; and

.6 that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity and nature of the particular Project, and that it will perform the Work with the care, skill and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All representations and warranties set forth in this Agreement, including without limitation, this Section 8.8.1, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition

.2 Bidding Documents

.3 AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as modified

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

N/A

. 5 Drawings

Refer to the attached **Exhibit B, List of Drawings**, all of which drawings listed therein are incorporated herein by reference.

(Table deleted)

.6 Specifications

Refer to the attached **Exhibit C, Specifications Table of Contents**, all of which sections listed therein are incorporated herein by reference.

(Table deleted)

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

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

[ ] AIA Document A132™–2019, Exhibit B, Determination of the Cost of the Work

[ ] AIA Document E235™–2019, Sustainable Projects Exhibit, Construction Manager as Adviser Edition, dated as indicated below:
(Insert the date of the E235-2019 incorporated into this Agreement.)

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[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232–2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Exhibit A Contractor's Bid Form
Exhibit B List of Drawings
Exhibit C Specifications Table of Contents

This Agreement is entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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AIA® Document A232™ – 2019

General Conditions of the Contract for Construction, *Construction Manager as Adviser Edition*

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

Bedford Fire Headquarters
550 Old Post Road
Bedford, NY 10506

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

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

Bedford Village Fire District
34 Village Green
Bedford, NY 10506

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

Architectural and Structural Engineering
PC Studio Architect, PLLC
1511 Route 22, Suite C-23
Brewster, NY 10509

Civil Engineering
Kellard Sessions
500 Main Street
Armonk, NY 10504

Mechanical and Electrical Engineering
OLA Consulting Engineers
50 Broadway
Hawthorne, NY 10532

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

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

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents. The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter, the "Agreement"), and consist of the Bidding Documents (including, but not limited to, Invitations to Bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of the addenda relating to bidding requirements), the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect.

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction (hereinafter, the "Contract"). The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

§ 1.1.3 The Work. The term "Work" means the construction and services required by the Contract Documents, or as reasonably inferable therefrom, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. The Work includes all of the Contractor's responsibilities as to all labor, parts, supplies, equipment, skill, supervision, transportation services, storage requirements, and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the Contract Documents and all other items of cost or value needed to produce, construct, and fully complete the Contractor's Work identified by the Contract Documents.

§ 1.1.4 The Project. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.5 Contractors. Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager, and include Multiple Prime Contractors.

§ 1.1.6 Separate Contractors. Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

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

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

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

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

§ 1.1.11 Architect. The Architect is, as appropriate to the context, the registered design professional, Architect or Engineer, preparing, in whole or in part, the Contract Documents, providing design and construction documentation, or providing Construction Administration Services for all or portions of this Project pursuant to an agreement with the Owner, and is referred to throughout the Contract Documents as if singular in number and masculine in gender. Where the term "Architect" is stated throughout the Contract Documents and herein, "Architect" shall refer to the Architect or Engineer, or possibly both, depending on the Architect's or Engineer's responsibility to the related item(s).

§ 1.1.12 Miscellaneous Definitions

§ 1.1.12.1 The terms "knowledge," "recognize" and "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill, and diligence required by the Contract Documents. The expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a contractor familiar with the Project and exercising care, skill, and diligence required of the Contractor by the Contract Documents.

§ 1.1.12.2 The term "any" in the Contract Documents shall be interpreted as "any and all" whenever one or more than one item would be applicable for completion of the Work.

§ 1.1.12.3 Except as otherwise explicitly provided, the words "approved" or "approval" shall mean the written approval of the Architect or the Construction Manager or both.

§ 1.1.12.4 "Accepted," "directed," "permitted," "requested," "required," and "selected" are used herein as term connections and unless specifically noted otherwise are to mean "accepted by the Architect," "directed by the Architect," "permitted by the Architect," "requested by the Architect," "required by the Architect," and "selected by the Architect." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's areas of construction supervision.

§ 1.1.12.5 The term "as indicated" or "as shown" shall mean "as indicated in the Contract Documents."

§ 1.1.12.6 The term "include" in any form other than "inclusive" is non-limiting and not intended to mean "all inclusive."

§ 1.1.12.7 The terms "furnish" and "furnish all materials," unless specifically noted otherwise, mean "pay for, supply and deliver to the job site all new materials, systems, equipment, product, or other items so specified."

§ 1.1.12.8 The terms "install" and "furnish all labor," unless specifically noted otherwise, mean "pay for, perform all operations connected with installation of Work including unloading new product to be installed, supplying all necessary equipment and rigs to do the Work, test, place in operation and service, and remove all packing material."

§ 1.1.12.9 The term "product" includes materials, systems, equipment, and other items to be incorporated into the Work.

§ 1.1.12.10 The term "provide," unless specifically noted otherwise, means "furnish new, install, connect up, complete, test and place in operation and service."

§ 1.1.12.11 The term "replace" or similar term shall mean "restore," "renew," "make good," "reconstruct," or "as applicable using new product."

§ 1.1.12.12 The terms "manufacturer" or "supplier" mean any person or entity which contracts to furnish materials to a Contractor, Subcontractor, or any Sub-subcontractor for use at the site of the Project.

§ 1.1.12.13 "Wiring" shall be understood to mean wires or cables with conduit, fittings, boxes, etc., installed complete.

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§ 1.1.12.14 "Piping" shall be understood to mean all pipes, fittings, nipples, valves and all accessories connected thereto.

§ 1.1.12.15 The Contract Time is the period of time specified in Article 3 of the Agreement for completion of the Work.

§ 1.1.12.16 Terms not otherwise defined herein shall have the meanings set forth elsewhere in the Contract Documents.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. It is intended that all plumbing, mechanical, electrical, and other systems will be complete and in proper operation, and that all construction components, whether part of such systems or otherwise, will be complete and in compliance with accepted construction practice upon completion of the Work. Even if items are missing from the Drawings or Specifications, but are normally required for proper operation of plumbing, mechanical, electrical, and other systems, or to complete otherwise incomplete construction, or to meet governing code requirements, they shall be included by the Contractor, unless he sought and received contradictory interpretation or clarification from the Architect.

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

§ 1.2.1.2 The Contractor and its Subcontractors shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including without limitation (1) location, layout, and nature of the Project site and surrounding areas, (2) existing building and site conditions, (3) anticipated labor supply and costs, (4) availability and cost of materials, tools, equipment, (5) Owner occupancy requirements and constraints, (6) site safety logistics plan and any phased construction plan and (7) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. No adjustments will be made in either the Contract Sum or Contract Time for any failure by the Contractor or any Subcontractor to comply with the requirements of this Section 1.2.1.2.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Instructions and other information furnished in the Specifications including, without limitation, items in connection with prefabricated or prefinished items, are not intended to supersede work agreements between employers and employees. Should the Specifications conflict with such work agreements, the work agreements shall be followed, provided such items are provided and finished as specified in the Contract Documents. If necessary, such work shall be performed on the Project site, instead of at the shop, by appropriate labor and in accordance with the requirements of the Drawings and Specifications.

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

§ 1.2.4 In the event of inconsistencies within or between parts of the Contract Documents or between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall (1) provide the better quality or greater quantity of work or (2) comply with the more stringent requirements; either or both in accordance with the Architect's interpretation. Where the Contractor perceives a conflict, it shall inform the Architect and Owner thereof and request a decision from the Architect, which shall be promptly communicated by the Architect to the Contractor so as not to cause any delay in the performance of the Work. Any Work performed after perceiving the conflict and prior to resolution by the Architect shall be at the Contractor's risk. The terms and provisions of this Section 1.2.4, however, shall not relieve the Contractor of any of the obligations set forth elsewhere herein.

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.1 The Contractor shall not scale Drawings. Dimensions on large scale drawings take precedence over dimensions on small scale drawings. The Contractor shall notify the Architect if additional dimensions are needed. The Contractor shall field verify all dimensions.

.2 Before ordering any materials or doing any work, the Contractor and each Subcontractor shall verify measurements at the Project Site and shall be responsible for the correctness of such measurements. The Contractor shall confirm all dimensions by field measuring. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference that may be found shall be submitted to the Architect for resolution before proceeding with the Work.

.3 If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

.4 Certain portions of the Specifications are written in condensed outline form and omitted words are to be supplied by inference. Naming of an article or operations shall have the effect of stating "Contractor shall furnish, install and complete" said operation or article unless it is further qualified in the context in which it appears.

.5 When reference is made to specifications of a manufacturer, trade association, governmental agency, reference standard or similar source (such as ASTM, ASA, AISC, ACI, etc.) such is made part of these Specifications, having the force and effect as though reproduced herein, and upon entering into the Contract the Contractor acknowledges his familiarity with those pertaining to his work. The date of the reference standard shall be the latest edition at the time of signing the Contract except as specifically indicated otherwise.

.6 The Contract Drawings are intended to show the general arrangement, design, and extent of the Work and are partly diagrammatic. They are not intended to be scaled for any purpose, or to serve as shop drawings. The Contractor and its Subcontractors will cooperate with all other contractors and their respective subcontractors in determining the construction of systems, running of pipe, and locating equipment. The Contractor agrees that the failure to repeat typical details, figures, or notes on all Contract Drawings or other Contract Documents will not be a basis for claims for additional cost or time.

.7 Any necessary variations in routing or installation shall be made to conform to the intent of the Contract Documents without additional costs. Where there are intersections or obstructions involving ducts, piping, or any other equipment requiring offset of materials, the Contractor acknowledges that it gave particular consideration to clearances in advance of submitting its bid, and that no additional costs for these issues will be considered by the Owner.

.8 If conflicting conditions or interferences develop, the Contractor and its Subcontractors will confer with the other contractors and their respective subcontractors whose work is affected to determine a solution acceptable to all interested parties. The suggested solution shall be submitted to the Architect for comment and, if necessary, written approval.

.9 The Contract Documents intend a first class finished product of such character and quality as described in and reasonably inferred from the Contract Documents. The Contractor will perform its Work to be complete and operable, fitting with the work of other contractors and the Owner, and in compliance with best construction practices and the ordinances, codes, and regulations of all bodies or persons having governmental or regulatory authority over the Contractor and its Work.

§ 1.2.5 Execution of the Contract by the Contractor is a representation that the Contractor has carefully examined the Contract Documents and the Project site, and represents that the Contractor is thoroughly familiar with the nature and location of the Work, the Project site, the specific conditions under which the Work is to be performed, and all matters which may in any way affect the Work or its performance. The Contractor further represents that as a result of such examinations and investigations, the Contractor thoroughly understands the Contract Documents and their intent and purpose, and is familiar with all applicable codes, ordinances, laws, regulations, and rules as they apply to the Work, and that the Contractor will abide by same. Claims for additional time or additional compensation as a result of the Contractor's failure to follow the foregoing procedure and to familiarize itself with all conditions and the Contract Documents will not be permitted.

§ 1.2.5.1 The Contractor certifies that it is experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the Work at various locations and

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orderly fashion and the completion of Work at various locations or levels at various times. This "phasing," "out of sequence," or "come back" work shall be done at no cost to other Contractors, the Owner or Architect.

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as

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otherwise provided in Section 4.2.1, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

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

§ 2.1.3 The Owner, Architect or Construction Manager shall not supervise, direct or have control or authority over, nor be responsible for, the Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with laws and regulations applicable to the furnishing or performance of the Work. The Owner, Architect and Construction Manager shall not be responsible for the Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

§ 2.2 Evidence of the Owner's Financial Arrangements – Intentionally Omitted.

(Paragraphs deleted)

§ 2.3 Information and Services Required of the Owner

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

§ 2.3.2 Intentionally omitted.

§ 2.3.3 The Owner shall retain a construction manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 2.3.5 The Owner shall make available for inspection, upon request, that field survey or testing information of existing conditions that is known to be available and that is held by the Owner at its offices. Such records and documents are not Contract Documents, and the Owner makes no representation as to their accuracy or completeness. Notwithstanding the foregoing, information furnished by the Owner in the form of surveys, subsurface investigation reports, soil borings, and other material of a similar nature, is for general information only and is not a guarantee of the completeness or accuracy of such information, unless specifically noted otherwise herein. The Contractor shall verify all existing grades, conditions, and dimensions of existing physical conditions and structures and shall report any inconsistencies in writing to the Architect. The Contractor shall establish all lines and levels required to execute the Work and shall bear all costs involved, and shall be responsible for their accuracy and maintenance.

§ 2.3.6 Intentionally omitted.

§ 2.3.7 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one set of Contract Drawings and the Project Manual for use during construction for its own use and for purposes of making reproductions pursuant to Section 1.5.2. The Owner shall furnish additional sets upon the Contractor's written request. Such additional sets will be provided at the cost of printing, postage and handling. Partial sets will not be provided. Subcontractors and other entities desiring copies of Drawings and the Project Manual will be provided sets at the cost of printing, postage and handling.

§ 2.3.8 The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

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§ 2.4 Owner's Right to Stop the Work

If the Contractor (1) fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2, or (2) fails to carry out Work in accordance with the Contract Documents as determined by the Owner, Architect or Construction Manager, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the Work within the Contract Time, or (4) fails to remove and discharge (within seven (7) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) fails to perform the Work in a safe manner and in compliance with all applicable health and safety requirements and the Contractor's site specific health and safety plan, or (6) disregards the instructions of the Architect, Owner or Construction Manager, as determined by the Owner, Architect or Construction Manager, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. Such order or stoppage by the Owner shall not constitute grounds for termination by the Contractor under Article 14 and shall not be a basis for an extension of the Contract Time under Section 8.3 or Article 15.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents (including but not limited to all applicable health and safety requirements) and fails within a three (3) work day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such three (3) work day period, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order or Construction Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services and other expenses made necessary by such default, neglect or failure. Such Change Order or Construction Change Directive shall be deemed to have been executed by the Contractor, whether or not actually signed by the Contractor. Such action by the Owner and amounts charged to the Contractor shall be equally binding upon the Contractor's performance and payment bond surety. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.6 Extent of Owner's Rights

The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

§ 3.1.2 The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

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

§ 3.1.4 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor. The Contractor shall maintain complete inspection records and test date to ensure the quality of the Work is in strict compliance with the requirements of the Contract Documents.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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§ 3.2.1.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.3.5 and shall at once report in writing to the Construction Manager and the Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner, the Construction Manager or the Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor knew or reasonably should have known of such error, inconsistency or omission and failed to report it as required by this section to the Construction Manager and the Architect. If the Contractor performs any construction activity knowing it involves, or reasonably should have known it involves, a recognized error, inconsistency or omission in the Contract Documents without such notice to the Construction Manager and the Architect, the Contractor shall assume full responsibility for such performance and shall bear sole responsibility for the costs for correction.

§ 3.2.1.2 The obligations of the Contractor under Section 3.2.1.1 and this Section 3.2.1.2 are for the purpose of facilitating construction by the Contractor and are not for the purpose of imposing an affirmative obligation on the Contractor to discover errors, omissions, or inconsistencies in the design information in the Contract Documents. The Contractor's review of the Contract Documents is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically so provided in the Contract Documents.

§ 3.2.1.3 Failure by the Contractor to promptly report any errors, inconsistencies, or omissions in the Contract Documents discovered by the Contractor, or which the Contractor reasonably should have known or discovered, shall constitute a waiver by the Contractor of any claim that otherwise might result in a change in the Contract Sum or Contract Time.

§ 3.2.2 The Contractor shall be presumed to have examined the Project site(s) to consider fully all conditions that may have a bearing on the Work and to have accounted for these conditions in its proposal. The Contractor is deemed to be a qualified expert in the systems and construction requirements of the Work of its Contract. The Contractor hereby specifically acknowledges and declares that the Contract Documents are full and complete, are sufficient to have enabled it to determine the cost of the Work, and that the Drawings, the Specifications, and all Addenda are sufficient to enable the Contractor to construct the Work outlined therein in accordance with applicable laws, statutes, building codes, and regulations, and otherwise to fulfill all of its obligations under the Contract Documents. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Construction Manager and the Architect at once. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other Contractors, is not guaranteed by the Architect, Construction Manager, or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, the Contractor shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner. Except as to any reported errors, inconsistencies or omissions, and except as to concealed or unknown conditions, by executing the Agreement, the Contractor represents to the Owner, Construction Manager, and the Architect that the Work required by the Contract Documents, including, without limitation, all construction details, construction means, methods, procedure and techniques necessary to perform the Work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (1) good and sound practices within the construction industry; (2) generally prevailing and accepted industry standards applicable to Work; (3) the requirements of any warranties applicable to the Work; and (4) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of the Work.

§ 3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Section 3.12.

§ 3.2.4 The Contractor may submit Requests for Information ("RFI") to the Architect, through the Construction Manager, to help facilitate the Contractor's performance of the Work. Prior to submitting each RFI, the Contractor shall first carefully study and compare the Contract Documents, field conditions, other Owner provided information, Contractor-prepared Coordination Drawings, and prior Project correspondence and documentation to determine that the information to be requested is not reasonably obtainable from such sources. The Contractor shall submit each RFI sufficiently in advance of the date by which such information is required in order to allow the Architect sufficient time

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to permit adequate review and response and to permit Contractor compliance with the latest construction schedule. The Contractor shall reimburse the Owner amounts charged by the Architect for RFI responses that in the opinion of the Architect were available from a careful review of the Contract Documents, field conditions, other Owner provided information, Contractor-prepared Coordination Drawings, and prior Project correspondence and documentation.

§ 3.2.5 If the Contractor, during the progress of the Work, discovers any discrepancies between the Drawings and the Specifications, errors or omissions on the Drawings, or any discrepancies between physical conditions of the Work and the Drawings, and has notified the Architect and Construction Manager in writing under Section 3.2.1, no deviations from the Contract Documents shall be performed by the Contractor until it receives approval in writing from the Architect through the Construction Manager. Any Work performed after such discovery without the approval of the Architect shall be at the Contractor's sole risk and expense.

§ 3.2.6 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and the Architect any nonconformity discovered by or made known to the Contractor as a RFI submitted to the Architect.

§ 3.2.7 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or RFIs pursuant to Sections 3.2.1, 3.2.2, 3.2.4, 3.2.5 or 3.2.6, the Contractor shall make a Claim as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.1, 3.2.2, 3.2.4, 3.2.5 or 3.2.6, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or the Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.8 The Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner. The Contractor shall report to the Construction Manager and Architect whenever any reference point 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 by professionally qualified personnel.

§ 3.2.9 Whenever the Drawings show existing or other construction not required as part of the Contract Work, it is understood that it is so shown as a matter of information and that the Owner, while believing such information to be substantially correct, assumes no responsibility thereof. The Contractor shall make itself familiar with all conditions affecting the nature and manner of conducting the Work.

§ 3.2.10 The Architect may require that the Work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed Work or the Work in progress.

§ 3.2.11 Claims for additional compensation or extension of time due to the Contractor's failure to familiarize itself with the conditions at the site will not be allowed.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention, and shall complete the Work in a good and workmanlike manner in accordance with the Contract Documents. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work subject to the coordination of the Construction Manager. Where the Drawings or Project Manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's Work, such reference is intended only to indicate that the Contractor's Work is to produce at least the quality of the work implied by the operations described, but the actual determination as to whether or not the described operations may be safely or suitably employed in the performance of the Contractor's Work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective Work arising from the employment of a specific construction means, method, technique, sequence or procedure shall be borne solely by the Contractor.

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§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, suppliers, and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors, Suppliers or Sub-subcontractors, and for any damages, losses, costs and expenses resulting from such acts or omissions, including but not limited to reasonable attorneys' fees.

§ 3.3.3 The Contractor shall be responsible for coordinating the work of its own forces and the work of Subcontractors engaged by it to perform the Work of the Project on its behalf. The Contractor shall supply to its own work forces, and Subcontractors engaged by it to perform portions of its Work, copies of the Drawings and Project Manuals for the work to be performed by such individual/entities on its behalf.

§ 3.3.3.1 The Contractor shall coordinate its operations and cooperate with those of other Contractors performing work on the Project or site thereof to ensure efficient and orderly installation of each part of the Work. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the Work. The Contractor shall remain informed of the progress and the detail work of other Contractors and shall notify the Construction Manager immediately of lack of progress or defective workmanship on the part of other Contractors, where such delay or such defective workmanship will interfere with Contractor's own operations. Failure of the Contractor to keep informed of the work progressing on the site or to give notice of lack of progress or defective workmanship by others shall be construed as acceptance of the progress of work and coordination with Contractor's own Work.

§ 3.3.3.2 The Contractor's obligations under the Contract Documents shall include, without limitation, the following:

- **.1** Review of all specified construction and installation procedures with its employees and Subcontractors, including, without limitation, those recommended by manufacturers, prior to the commencement of the relevant portion of the Work to be performed.
- **.2** Advising the Construction Manager and the Architect:
  - **.1** if a specified procedure deviates from best construction practice;
  - **.2** if following a procedure will affect any warranties, including the Contractor's general warranty; or
  - **.3** of any objections the Contractor may have to a procedure.
- **.3** Proposing alternative procedures, as appropriate, which procedures shall be covered by the Contractor's warranty as described in Section 3.5 hereof.
- **.4** The Contractor shall be responsible for organizing and conducting pre-installation conferences and must coordinate such conferences with the Architect and the Construction Manager.

§ 3.3.3.3 The Contractor and its Subcontractors working on the Project shall attend a preconstruction conference(s) or meeting(s) as deemed necessary by the Construction Manager to coordinate all Work (e.g., demolition, installation, etc.), and as required by the Project Manual.

§ 3.3.4 Where equipment lines, piping, ductwork, or conduit are shown diagrammatically, the Contractor shall be responsible for the coordination and orderly arrangement of the various lines of piping and conduit included in the Work of its Contract. The Contractor shall coordinate the work of its Subcontractors and prevent all interferences between or among equipment, lines of piping, and architectural features, and avoid any unsightly arrangements in exposed areas. This Section shall not be construed as limiting any obligation of the Contractor under any other provision of the Contract Documents.

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

§ 3.3.6 The Contractor, its employees and Subcontractors, shall be subject to such rules and regulations for the conduct of Work as the Owner may establish, including but not limited to, the WORK RESTRICTIONS Section of the Specifications. The Contractor shall be responsible for the enforcement among its employees and Subcontractors of the Owner's instructions and restrictions.

§ 3.3.7 The Contractor shall inspect all materials as delivered to the Project site and shall reject any materials that will not conform with the requirements of the Contract Documents when properly installed.

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§ 3.3.8 The Contractor shall be responsible for and coordinate any and all inspections required by any governmental body having jurisdiction over the Project. Failure to obtain any permits, licenses or other approvals because of the failure of the Contractor to conform to this requirement shall not extend the Contract time, and the Contractor shall not be entitled to any increase in the Contract Sum therefore. In addition, any additional costs and expenses of any nature incurred by the Owner as a result of the Contractor's failure to conform to this requirement shall constitute a charge against the Contractor's Contract.

§ 3.3.9 Shut Downs: Such work as connections to existing sewers, plumbing, heating, and electrical systems shall be coordinated at a time agreeable to the Owner, the Architect, and the Construction Manager, and shall be determined and agreed to well in advance of the actual performance of such work so as to interfere as little as possible with the operation and use of the Owner's existing facilities. Shut downs must be coordinated through the Construction Manager. The continued uninterrupted operation of all facilities of the Owner's buildings is essential. If any existing facilities must be interrupted, the Contractor for the Work shall provide all necessary temporary facilities and connections necessary for maintaining these existing facilities at no increase in the Contract Sum except as otherwise specified. No mechanical, heating, plumbing, sprinkler, or electric service shall be interrupted at any time except as approved in advance by the Owner or when the buildings are not occupied and shall be coordinated with the Owner, as well as the Construction Manager. All communication systems must be maintained without interruption. As much related work as possible shall be performed prior to shut downs, so as to minimize the period of shut down. All material, equipment, and manpower necessary in the performance of a shutdown shall be on site prior to interruption of service.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor (at applicable prevailing wage rates), materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The Contractor shall work continuously and expeditiously through completion of the Work. Time is of the essence.

§ 3.4.1.1 A shortage of labor in the industry shall not be accepted as an excuse for not properly manning the Project at each site.

§ 3.4.1.2 The Contractor shall be responsible for the care and protection of all equipment and materials for its Work on the Project, including equipment and material furnished by the Owner.

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

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them, or persons who within the last two weeks (a) having been exposed to someone having been diagnosed with a COVID-19 infection; or (b) having had a persistent cough, shortness of breath, or a fever of 100.4 or higher. The Owner reserves the right to have any persons removed from the Project upon reasonable objection.

§ 3.4.3.1 In addition to all other safety requirements, the Contractor shall provide suitable and a sufficient number of safety related facilities and personal protective equipment (PPE) at the site related to protection against the spread of COVID-19, including but not limited to handwashing stations, hand sanitizer, gloves, masks, faceshields, and other equipment as the Owner may reasonably request. Notwithstanding the foregoing, nothing herein shall be construed to delegate or relieve Contractor from having sole and exclusive responsibility for all worksite safety.

§ 3.4.4 At least twenty-five percent (25%) of the direct labor, materials, systems or equipment shall be provided by the Contractor. The unit measure (dollar value, unit price, schedule of value) used to determine the quantities of work, labor and material furnished by the Contractor shall be determined by the Construction Manager and the Architect and shall be appropriate for the scope of Work involved. Work performed by supervisory personnel, above the level of

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foremen, or office personnel, all overhead costs, including bonds and insurances, shop drawings and similar items shall not count toward the percentage of self-performed Work provided by the Contractor.

§ 3.4.5 All mechanics employed on the Project shall be persons skilled in that work which they are to perform. Work will not be approved if it does not meet the quality of workmanship as called for in the Contract Documents. If this quality of workmanship is not exactly defined herein, it shall be assumed to be the best standards of workmanship for the trade. Employees of the Contractor or its Subcontractors whose work is unsatisfactory to the Owner, Construction Manager or Architect, or considered by them to be unskilled or otherwise objectionable, will be immediately dismissed from the Project upon notice from the Construction Manager. Those dismissed employees shall be immediately replaced by the Contractor so as not to delay progress of the Work and at no additional cost to the Owner.

§ 3.4.6 On receipt of the signed Contract, the Contractor will be expected to place firm orders with vendors for needed materials, including Subcontractors and major material suppliers. If deemed necessary to assure delivery of materials at times needed, the Contractor may accept delivery of such materials at any time, and may include the cost of such materials in its next monthly Application for Payment, provided such materials have actually been delivered to Contractor and properly stored by it with approval or under direction of the Architect and the Construction Manager either at the Project site or in an approved storage shed or warehouse, as provided elsewhere in these General Conditions.

§ 3.4.6.1 To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If Contractor is given option of selecting between two or more products for use on the Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

§ 3.4.6.2 The Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors. If a dispute arises between the Contractor and other contractors over concurrently selectable but incompatible products, the Architect will determine which products shall be used.

§ 3.4.6.3 With respect to sitework materials, all products submitted for use and incorporated into the Project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

§ 3.4.6.4 When required, off-site storage shall be the responsibility of the Contractor. If materials are stored off site, the Contractor shall furnish proof of title by Owner and provide a certificate of insurance demonstrating adequate insurance coverage.

§ 3.4.6.5 The Contractor shall deliver all materials at such times as will ensure speedy and uninterrupted progress of the Work.

§ 3.4.7 The Contractor warrants that it has good title to all materials used by it in, on or in connection with the Work. No materials or supplies shall be purchased by the Contractor or any of its Subcontractors that are subject to any chattel mortgage, conditional sale or other agreement by which an interest is retained by the seller.

§ 3.4.8 The Contractor shall make every reasonable effort to avoid labor disputes and to insulate the Owner, Architect and Construction Manager from the effects of labor disputes should any arise. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the Project for any reason by anyone employed or engaged by the Contractor to perform its portion of the Work. There shall be no lockout at the Project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the Work under any circumstance. For the purposes of this Section, every reasonable effort shall include, but not necessarily be limited to:

.1 make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect, the Construction Manager or the Owner, any conflict between its Agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade;

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.2 requiring employees, Subcontractors, suppliers and others to use reserve gates which shall be established for the Project;

.3 rearranging work schedules for the Contractor's Work or the work of its Subcontractors; and

.4 including in Contractor's agreements with its Subcontractors the right to fully implement all provisions of this Section.

§ 3.4.8.5 In case the progress of the Work is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to the Contract because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the Work.

§ 3.4.8.6 The Contractor shall ensure that its Work continues uninterrupted during the pendency of a labor dispute.

§ 3.4.8.7 The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes arising from the labor practices of the Contractor or its Subcontractors, Suppliers or Sub-subcontractors.

§ 3.4.9 The Contractor and its Subcontractors employed upon the Work shall abide by and conform with all labor laws and to all other laws, ordinances, and legal requirements now or hereafter applicable to the Work or the construction area.

§ 3.4.10 The Contractor and its Subcontractors shall be responsible for protection of the Work, the work of Separate and other Contractors, and existing construction, both on and off the site, and in the event of damage, shall restore the same to the original condition at no additional cost to the Owner.

§ 3.4.11 If the Work is to be performed by trade unions, the Contractor shall, with the consent of the Owner and the Architect, which shall not be unreasonably withheld, make all necessary arrangements to reconcile, without delay, damage, or cost to the Owner, any conflict between the Contract Documents and any agreements or regulations of any kind, at any time in force among members or councils that regulate or distinguish what activities are included in the work of any particular trade.

§ 3.4.12 No new asbestos containing building materials shall be used in construction. No materials containing asbestos in any form shall be used in, on, or around the Owner's buildings**.**

§ 3.4.13 Equivalents and Substitutions

§ 3.4.13.1 Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the Contractor desires to use any kind type, brand, or manufacturer or material other than those named in the Specifications, it shall indicate in writing, and prior to award of the Contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for equivalents as provided in the Project Manual. Any proposed equivalent shall not be purchased or installed by the Contractor without the Architect's review process having been completed and the product accepted by written notification.

§ 3.4.13.2 Substitutions. After the Contract has been executed, the Owner, Construction Manager and Architect will consider a formal request for the substitution of products in place of those specified only under conditions set forth in the General Requirements of the Specifications.

§ 3.4.13.3 By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor: (1) represents that it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified; (2) represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product; (3) certifies that the cost data is complete and includes all related costs under the Contract, including professional services necessary or required for the Architect or its consultants to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent; (4) represents that it will coordinate the installation of the accepted substitute, making all such changes to the Drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and ventilating Specifications as may be required for the Work to be complete in all

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respects; and (5) represents that it will reimburse the Owner for all additional costs billed by the Architect or its consultants for the review of the substitution request(s), any redesign of the Work of this Contractor or associated contractors, additional site visits related to the substitution request and for the work to prepare Change Orders or Construction Change Directives.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. All warranties and guarantees specifically called for by the Contract Documents shall expressly run to the benefit of the Owner. If required by the Architect, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable supplier, except as otherwise provided in the Contract Documents. The Contractor shall perform the Work in strict accordance with the Contract Documents and best industry practices. The Contractor, at its expense, shall upon demand by the Owner, Construction Manager or Architect remove and replace materials not meeting specifications or materials failing to perform as represented or warranted by the manufacturer, regardless of whether incorporated into the Work. The Contractor shall promptly replace or correct any Work or materials that the Owner, Construction Manager or Architect rejects as failing to conform to the requirements of the Contract Documents. The foregoing warranty obligations shall survive completion or termination of the Contract, are not limited by the provisions of Article 12, and are in addition to and not in limitation of any other warranty, right or remedy set forth in the Contract Documents or otherwise prescribed by law.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4. The Contractor shall assign to the Owner at the time of final completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such manufacturer's warranties. The Contractor shall fully cooperate with the Owner in the event the Owner pursues remedies under any warranties assigned to the Owner. The Contractor acknowledges that its obligations to the Owner under this subparagraph are joint and several with its Subcontractors, suppliers, and material or equipment manufacturers of all materials and equipment supplied on account of the Work.

§ 3.5.3 Neither final payment nor provision in the Contract Documents nor partial or entire occupancy of premises by Owner shall constitute an acceptance of Work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibilities for faulty or defective materials or workmanship.

§ 3.5.4 All required maintenance shall be the Contractor's responsibility until the Owner has accepted the Project as complete, all required maintenance and user's manuals have been turned over to the Owner, and the Owner's designated personnel have been instructed in the maintenance and operation of all applicable materials. This maintenance shall include a complete turnover procedure at the time of completion, including complete cleaning, testing and adjustment. The Contractor shall keep records of all such maintenance performed as required by this Section, including work performed and times and dates on which it was performed. These records shall be turned over to the Owner at closeout.

§ 3.5.5 The Contractor shall in case of work performed by its Subcontractors, and where guarantees are required, secure warranties from Subcontractors and deliver copies of same to the Construction Manager countersigned by the Contractor.

§ 3.6 Taxes

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

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§ 3.6.1 The Owner is exempt from payment of federal, state, and local sales and compensation use taxes on all supplies and materials incorporated into and becoming an integral component part of the structures, buildings, or real property pursuant to this Contract. Such taxes are therefore not to be included in the Contractor's bid or the Contract Sum. The Owner shall deliver to the Contractor the appropriate exemption certificate required to be supplied by the Owner, and the Contractor and its Subcontractors and materialmen shall be solely responsible for obtaining and delivering any and all exemption or other certificates and for furnishing a Contractor Exempt Purchase Certificate or other appropriate certificates to all persons, firms, or corporations from whom they purchase supplies, materials, and equipment for the performance of the Work.

§ 3.6.1.1 The Contractor's attention is called to fact that materials not actually incorporated into Work will not be exempt from payment of sales or compensating use taxes, and the Contractor and its Subcontractor shall be responsible for and shall pay any and all applicable taxes. This will apply to such things as:

- **.1** construction machinery and equipment including rentals or repair parts;
- **.2** The Contractor's office supplies;
- **.3** The Contractor's supplies, tools and miscellaneous equipment including forms, materials and scaffolding (whether purchased or rented);
- **.4** temporary heat;
- **.5** telephone or electric services; and
- **.6** any other items purchased or rented by the Contractor for the Contractor's use in performing its Work and not incorporated into realty.

§ 3.6.2 The Contractor accepts full and exclusive liability for payment of any and all contributions, assessments or taxes for unemployment insurance or old age insurance, or annuities now or hereafter imposed by the government of the United States, or by the government of any city, county or state of United States, which are measured by salaries or other remuneration paid to persons employed by the Contractor or any Subcontractor for Work performed under this Contract.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

(Paragraph deleted)

§ 3.7.1.1 The Contractor shall, as soon as practicable, furnish the Owner, Architect, and Construction Manager with copies or certificates of all permits, fees, licenses, and inspections necessary for the proper execution and completion of the Work, including, without limitation, all applicable building permits other than those required of the Owner under Sections 2.2.1 and 3.7.1. All inspection fees and other costs of such permits and licenses required to be obtained by the Contractor as may be imposed by any municipal or other entity shall be paid by the Contractor and shall not serve as the basis for any increase in the Contract Sum.

§ 3.7.2 The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (a) the Owner, its consultants, employees, officers and agents and (b) the Architect, Construction Manager and their consultants, employees, officers and agents against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder.

§ 3.7.2.1 In accordance with New York State Labor Law Article 8, Section 220, subd. 3-a(a), the Contractor shall submit to the Owner within 30 days after issuance of Contractor's first payroll, and every 30 days thereafter, a transcript of the original payroll record, subscribed and affirmed as true under the penalties of perjury.

§ 3.7.2.2 The Contractor shall comply with all applicable New York State Department of Labor requirements, including the provision that every worker employed in performance of a public work contract shall be certified as having completed an OSHA 10-hour safety training course. The Contractor and its Subcontractors shall be solely responsible for compliance with this requirement with respect to their employees. The Contractor's or Subcontractor's failure to comply with this requirement shall not transfer or in any way impose the responsibility for worker safety upon the Owner or the Architect.

§ 3.7.3 If the Contractor performs Work contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall

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bear all costs attributable to the correction thereof or related thereto, including reimbursement to the Owner for any additional services required of the Construction Manager or Architect or both, as well as all fines and penalties, if any.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall give prompt written notice to the Owner, Construction Manager, and the Architect of such conditions before they are disturbed or affected work is performed and in no event later than five (5) business days after first observance of the conditions. The Architect or Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Contractor disputes the Architect's determination or recommendation, it may proceed as provided in Article 15. No adjustment in the Contract Time or Contract Sum will be permitted, however, in connection with a concealed or unknown condition that does not differ materially from those conditions disclosed or that reasonably should have been disclosed by the Contractor's (1) prior inspections, tests, and reviews, or (2) inspections, tests, and reviews the Contractor had the opportunity to make or should have performed in connection with the Project.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents:

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

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor, within seven (7) days of Notice of Award, shall designate the Project Manager, Superintendent and other key individuals who shall be assigned to the Project through and including Final Completion. Such designations shall be in writing and provided to the Construction Manager, Architect and Owner and shall include the qualifications of such individuals. The Superintendent shall be in attendance at the Project site throughout the work, remain on the Project site not less than eight hours per day, five days per week, until termination of the Contract, unless the job is suspended, work is stopped by the Owner, or no work is scheduled. The Superintendent shall be

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approved by the Owner in its sole discretion. Said representatives shall be qualified in the type of work to be undertaken and shall not be changed during the course of construction without the prior written consent of the Owner. Should a representative leave the Contractor's employ, the Contractor shall promptly designate a new representative. The Owner shall have the right, at any time and in its sole discretion, to direct a change in the Contractor's representatives if their performance is unsatisfactory. In the event of such a demand, the Contractor shall within seven (7) days after notification thereof, replace said individual(s) with an individual(s) satisfactory to the Owner, in the Owner's sole discretion. If said replacement is disapproved, the Contractor may, at the Owner's option, be terminated for cause. The Superintendent shall represent the Contractor, and communications given to the Superintendent shall be as binding as if given to the Contractor. The Owner shall have no obligation to direct or monitor the Contractor's employees. All references herein to the Superintendent shall be taken to mean the Contractor's superintending staff. Each Subcontractor shall designate the Project Manager, Superintendent and other key individuals who shall be assigned to the Project. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case. The Contractor's Superintendent shall attend all Project meetings, regardless of whether held prior to or following Substantial Completion of the Work.

§ 3.9.2 The Contractor shall provide, or otherwise see that, the Project Manager or Superintendents or responsible workers of the Contractor and its major Subcontractors are equipped with cellular phones and radios. The Contractor shall provide the Owner, the Construction Manager and the Architect with the number for each phone and worker.

§ 3.9.3 The Contractor's supervisory personnel, including Superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, Superintendents and their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter to facilitate communications with such supervisory personnel.

§3.9.4 The Contractor shall not reduce or terminate supervision of the Work, nor change the superintendent without the prior written approval of the Owner.

§3.9.5 If, for any reason, the Contractor takes an action resulting in any of the changes noted in Subsection 3.9.4, the Owner may take remedial action to insure continued progress of the Work, including the hiring of suitable supervisory personnel, and charge the Contractor all costs associated with these remedial actions including the costs of legal and additional construction management and architectural services.

§ 3.9.6 The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly as set forth in Specifications Section 01 31 19, unless otherwise designated by the Owner, Construction Manager or the Architect. The Contractor shall have responsible representation at the mandatory weekly job progress meetings held at the Construction Manager's job office. These progress meetings will be held to arrange for satisfactory coordination of all trades on the Project so as not to impede job progress. If the Contractor or its Subcontractors fails to attend job meetings, the Contractor shall be responsible for delays and expenses incurred due to coordination difficulty.

§ 3.9.7 The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including Work activities on site and manpower.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, within seven (7) days of Notice of Award, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work in electronic format with predecessor logic. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the dates of Substantial Completion and final completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The Contractor's construction schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The Contractor's construction schedule shall be updated every thirty (30) days and submitted to the Construction Manager with the Contractor's Applications for Payment.

§ 3.10.1.1 Time is of the essence for this Project. The Work shall be performed continuously and without interruption, so that all Work can be completed in the time set forth in the Contract Documents.

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§ 3.10.1.2 The sequence of the Work shall be scheduled with the Owner so as to minimize interference with the Owner's use of existing structures.

§ 3.10.2 The Construction Manager shall prepare, publish, and, from time-to-time, revise a master integrated Project Schedule based upon the construction schedules submitted by the Contractor and other Contractors. Failure by the Contractor to furnish any required schedule or schedule revision in a timely manner shall entitle the Construction Manager to prepare a schedule for the Contractor's Work, to which the Contractor shall be bound.

§ 3.10.2.1 The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict, delay in or interference with the Work of other Contractors or the construction or operations of the Owner's own forces. The Owner shall have the right, without penalty, to direct the Contractor to delay, postpone or reschedule any portion of the Work that may interfere with or disrupt the operations of the Owner.

§ 3.10.3 The Contractor's construction schedule shall be in a detailed precedence style critical path management ("CPM") or Primavera-type format satisfactory to the Owner and Construction Manager that shall also: (i) provide a graphic representation of all activities and events that will occur during the performance of the Work; (ii) identify each phase of construction and occupancy; and (iii) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents.

§ 3.10.4 In the event the Owner determines that the performance of the Work has not progressed to the level of completion required of the Contract Documents or that the Contractor has failed to maintain its construction schedule or the Project Schedule, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction including without limitations, additional shifts, overtime, additional manpower or equipment as well as other similar measures (hereinafter referred to collectively as "extraordinary measures"). Such extraordinary measures shall continue until the progress of Work complies with milestone and critical path dates set forth in the Contract Documents and the Project Schedule. The Contractor shall not be entitled to an adjustment in Contract Sum or Contract Time in connection with extraordinary measures required by the Owner.

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

§ 3.10.6 The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project Schedule that is prepared by the Construction Manager. The Contractor shall revise the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project Schedule and the Contract Documents.

§ 3.10.7 The Contractor shall perform the Work in general accordance with the most recent construction schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project Schedule. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and Project Schedule and shall promptly advise the Owner of any delays or potential delays affecting the critical path.

§ 3.10.8 If the Contractor fails to maintain the approved construction schedule or Project Schedule and meet all critical path dates for the Work, the Owner may request a recovery plan from the Contractor and reserves the right to withhold payment until such time as the Contractor submits a recovery plan. The recovery plan must show how the Work may plausibly be brought on schedule, including, as necessary, acceleration of the Work by means of overtime, additional crews, additional shifts, additional equipment or re-sequencing of the Work to achieve completion of the remaining critical path dates in the construction schedule or Project Schedule. The Contractor shall submit as part of its recovery plan: (i) a "resource loaded" schedule showing the Contractor's plan to deploy manpower per trade, per work area, per day, together with essential materials and equipment, and other resources necessary to timely accomplish the Work; and (ii) a two-week "look ahead" schedule identifying tasks to be accomplished within the coming two week period,

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the work areas and categories of work, and necessary manpower resources, together with other data necessary to demonstrate to the Owner the viability of the Contractor's recovery plan ("2 Week Plans"). The Contractor shall continue to submit 2 Week Plans until either the Contractor demonstrates that the Project Schedule has recovered from the unexcused delay, or the Owner notifies the Contractor in writing that further 2 Week Plans are no longer required. The cost of preparing and performing the recovery plan shall be borne solely by the Contractor. No approval or consent by the Owner of any plan for resequencing or acceleration of the Work submitted by Contractor shall constitute a waiver by Owner of any damages or losses which the Owner may suffer by reason of such resequencing or the failure of Contractor to meet the Substantial Completion Date or the final completion date.

§ 3.10.9 The Contractor specifically represents and warrants to the Owner that that the Contract Sum and the Contract Time contemplate compliance with all current, and reasonable foreseeable future, federal, state and local "Stay at Home," "Social Distancing" and related orders, regulations and guidance related to limiting the spread of COVID-19 disease (the "COVID Requirements"). Accordingly, the Contractor hereby waives any claim for an increase in the Contract Sum or an extension of the Contract Time on account of the COVID Requirements. The Contractor shall promptly notify the Owner of any COVID Requirements that would impact the Project.

§ 3.10.10 Due to the ongoing COVID-19 pandemic and the resulting uncertainty with regard to, among other things, (a) what restrictions, if any, will be applicable to construction activities due to federal, state or local orders, laws, regulations or rules related to the COVID-19 pandemic (including, without limitation, social distancing, PPE, cleaning and disinfection requirements) and (b) the duration of any restrictions imposed on construction activities, the Owner may modify the construction schedule set forth in the Contract Documents. Similarly, restrictions, if any, that will be or are applicable to construction activities due to federal, state or local orders, laws, regulations or rules related to the COVID-19 pandemic (including, without limitation, social distancing, PPE, cleaning and disinfection requirements) may cause the Owner to have the Work or the Project commence later than the date specified in the Contract Documents. The Contractor acknowledges and agrees that there should be no additional compensation paid for schedule modifications caused directly or indirectly by the COVID-19 pandemic. The Contractor further acknowledges and agrees that its sole remedy for any schedule modifications or delays caused directly or indirectly by the COVID-19 pandemic shall be an extension of the Contract Time, if warranted. The Contractor further acknowledges and agrees that it shall have on file and provide a copy to the Owner of its written COVID-19 business reopening plan, and it shall comply in all respects with such plan for the duration of the Project. The Contractor, not the Owner, shall be responsible for compliance with its COVID-19 business reopening plan and all safety requirements associated with COVID-19 protections for workers and the general public.

§ 3.11 Documents and Samples at the Site

§ 3.11.1 The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These documents shall be available to the Architect and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 The Contractor shall maintain at the site, and shall make available to the Owner, Construction Manager and Architect, one record copy of the Drawings (the "Record Drawings") in good order. The Record Drawings shall be prepared and updated during the prosecution of the Contractor's Work. The prints for Record Drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the Work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural or structural changes in the design; and (vi) such other information as either the Owner or Architect may reasonably request. At the completion of the work, the Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower righthand corner. The colored record drawings and the as-built reproducible drawings and a digital copy of same shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to Contractor until the Record and As-Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

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§ 3.11.3 The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies having jurisdiction over the Project. All approved drawings shall be wrapped, marked and delivered to the Owner within 60 days of final completion of the Contractor's Work.

§ 3.12 Shop Drawings, Product Data, and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work. Each submittal shall bear written confirmation that the Contractor has satisfied its obligations under the Contract Documents with respect to the Contractor's review and approval of the submittal.

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.4.1 Shop Drawings and product submittals for all site improvement, architectural, structural, mechanical, electrical and signal work shall be submitted to the Architect for its review. Refer to the Specifications Section 01 33 00 – "SUBMITTAL PROCEDURES" for more complete information.

§ 3.12.4.2 The Contractor represents and warrants that all shop drawings shall be prepared by a person or entity possessing expertise and experience in the trade for which the shop drawing has been prepared and, if required by the Contract Documents or law, by a licensed professional engineer.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Contractors.

§ 3.12.5.1 No extension of time will be granted to the Contractor because of failure to have Shop Drawings, Product Data, Samples or similar submittals submitted in ample time to allow for review by the Architect or its consultants.

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

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been reviewed and approved by the Architect. Resubmission of rejected documents shall be performed within ten (10) calendar days, or sooner if required by the progress of construction. No claim for delay or cost shall be accepted as a result of rejected submittal documents. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review.

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

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions. Resubmission of rejected documents shall be performed within ten (10) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

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

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

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

§ 3.13 Use of Site

§ 3.13.1 The Owner shall not be liable to the Contractor, its Subcontractors of any tier, Suppliers, their employees or anyone else with respect to the condition of the Project site. The Owner shall have the right to refuse admittance to the site to any agent or employee of the Contractor, its Subcontractors of any tier, or its Suppliers whose presence the Owner deems hostile to the Owner's interests. The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. The use of the Owner's assets and property are extremely limited. The Contractor shall fully comprehend the intent of the Contract Documents pertaining to site and building limitations including, without limitation, Division 1 Specifications sections, the phased construction plan, and the site safety and logistics plan(s).

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§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.13.3 The Contractor shall perform and shall ensure that all its Subcontractors and Suppliers perform all Work in a manner that permits reasonable access to the Project site and to all adjacent premises. The Contractor shall not, and shall not permit any Subcontractor or Supplier to, conduct the Work in a manner that disturbs or that could be reasonably anticipated to disturb operations and persons located in or on portions of the site not affected by the Work. The occupied portion of any of the Owner's buildings shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

§ 3.13.4 Only materials and equipment that are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor.

§ 3.13.5 The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work will be performed in such a manner that public areas adjacent to the site of the Work will be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work; or (2) the building in the event of partial occupancy, as more specifically described in Paragraph 9.9.

§ 3.13.6 The Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories and toilets. To gain access to the Work, entrances and parking areas will be designated by the Owner for the Contractor's use. Without limitation of any other provision of the Contract Documents, the Contractor will comply with all reasonable rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Owner's building(s), as amended from time to time by the Owner.

§ 3.13.7 Construction areas that are under the control of the Contractor and therefore not occupied by the Owner shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the Owner's building(s). Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.

§ 3.13.8 Prior to starting Work, the Contractor shall submit a written report to the Owner, Construction Manager and Architect identifying existing damage to roads, walks, lawns, buildings and other property to be affected by this Contract. Failure to submit the report shall render the Contractor responsible for existing damage. The Contractor may request and schedule an inspection with the Owner, Construction Manager and Architect prior to submittal of the report. The Contractor shall obtain the consent of adjoining property owners regarding temporary easements of any other manner of physical encroachment.

§ 3.14 Cutting and Patching

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

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

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§ 3.14.3 The word "new" used herein shall mean Work which has been or is to be installed under the terms of the Contract for this Project. The word "existing" used herein shall mean existing conditions previous to the award of a Contract for this Project. In order to eliminate cutting and patching as much as possible, the Contractor shall, during the progress of its Work, provide and set proper sleeves, inserts, and other fixtures as required for its new Work and shall give proper and detailed instructions to others where the Work may be affected by their work, with adequate notice prior to the erection of new Work. Cutting and patching work as required to install new Work or remove existing work shall be done carefully and neatly with as little damage as possible. The Contractor shall refer to the Specifications for proper cutting and patching requirements. Any costs caused by defective or ill-timed Work of the Contractor shall be borne by the Contractor. Cutting and patching of any Work shall be made in such a manner as to not breach any provisions of any guaranty or warranty on existing work left in place or any guaranty or warranty required for the Contractor's new Work. Patching of work shall match existing adjacent surfaces and patchwork shall be disguised completely to hide any trace of patching. All new Work on existing roofs must be provided by a company specializing in performing the Work and approved by the existing roofing material manufacturer. It shall be the responsibility of the Contractor performing the cutting and patching to maintain any existing roofing warranty.

§ 3.14.4 Only trades persons skilled and experienced in cutting and patching shall perform such work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. On a daily basis, the Contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery and surplus materials. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project. The Contractor shall completely clean the site of the Work, removing and disposing of all construction-related debris and rubbish, and cleaning all Work-related stains, spots, marks, dirt, mortar smears, plaster smears, paint smears, caulking smears, and other foreign materials from exposed surfaces inside and outside the Owner's buildings and within the Project limit lines.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor. At its option, the Owner may deduct the cost of clean-up pursuant to this Section 3.15.2 from any payments otherwise due to the Contractor pursuant to this Contract.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located. Federal, state, and local agencies with jurisdiction over the Project shall at all times have access to the Work wherever it is in preparation or progress. The Contractor shall provide for such access so that such agencies may perform their functions. The Contactor shall also allow access for all required tests and inspections.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager, and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner, Architect, or Construction Manager. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect through the Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall, and cause its Subcontractors to, defend, indemnify and hold harmless the Owner, Construction Manager, Architect, and their consultants, officers, directors, board members, agents and employees of any of them (collectively, "Indemnitees," individually, "Indemnitee") from and against all losses, damages, liabilities, actions, causes of action, claims, demands, fines, penalties, judgments, costs (including but not limited to attorneys' fees and expenses incurred in connection therewith and in the enforcement of this indemnification), charges, expenses and demands of whatever kind in connection with or arising from or out of (a) any negligent, willful or wrongful act or omission resulting in bodily injury (including death), personal injury or

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property damage (including loss of use) by the Contractor, its Subcontractors and Suppliers, their respective officers, employees, servants, agents, suppliers, invitees, successors and assigns (collectively, "Contractor Parties," and individually, "Contractor Party"), (b) performance of or failure to perform the Work or any breach of this Contract or infringement of any patent right by any Contractor Party, or (c) any statutorily imposed liability for injury to employees or failure to comply with any laws or regulations affecting the Work, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Nothing contained herein shall be construed to obligate the Contractor to indemnify, defend, and hold an Indemnitee harmless for claims caused solely by the Indemnitee's negligent acts or omissions.

The Contractor agrees to include the following indemnity provision in each and every contract it enters into with a Subcontractor, and to require that Subcontractor to include such provision in each contract it enters into with any lower tier Sub-subcontractor: "To the fullest extent permitted by law, sub-contractor shall defend, indemnify and hold harmless the Contractor, Owner, Owner's Consultants, Construction Manager's and Architect's consultants, and each of their respective representatives, board members, employees, directors, officers, and agents, from and against any and all claims, suits, actions, damages, losses, fines, penalties, costs, charges and expenses, including but not limited to attorneys' fees and the costs of any proceeding, arising out of or resulting from any performance of or failure to perform the Work, acts or omissions of the Subcontractor, its lower-tier Sub-subcontractors, and others for whom the Subcontractor is responsible, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or economic losses or damages, damage to or destruction of property, and for environmental damage, or to injury to or destruction of tangible property and nuisance, but only to the extent caused by the acts or omissions or a breach of contract of the a Subcontractor, a Sub-Subcontractor to Subcontractor, and any person or entity directly or indirectly employed by them or any person or entity for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder."

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

§ 3.18.3 The Contractor's defense and indemnity obligations under this Section 3.18 shall specifically include all claims and judgments that may be made against the Indemnitees under the Labor Law of the State of New York, and similar laws of other state or governmental bodies having jurisdiction; and further, against claims and judgments arising from violation of public ordinances and requirements of governing execution of the Work.

§ 3.18.4 Claims by Governmental Authorities. To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against claims, damages, losses, and expenses arising out of any claims made against the Indemnitees under the laws of federal, state, or other governmental bodies having jurisdiction over the Work, including but not limited to claims arising from violation of public ordinances and other requirements of governing authorities, due to the Contractor's method of execution of the Work or implementation of any of the Contractor's other obligations under the Contract Documents.

§ 3.18.5 Liens and Security Interests. To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any actions, law suits, or other proceedings brought against Indemnitees as a result of liens or security interests of any type arising from the Work and filed against the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor, or any portion of the property of any of the Indemnitees.

§ 3.18.6 Intellectual Property. The Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any claim or demand for patent fees, royalties, or otherwise on account of any invention, machine, article, process, copyright, or arrangement that may be used by the Contractor in performing the Work, other than as to any of the foregoing expressly called for in the Contract Documents to be so used. In the event of any injunction or legal action regarding such claim or demand that results in stopping the Work in whole or part, the Owner shall have the right to direct the Contractor to change the manner of performance of the Work to avoid such stoppage, all cost and expense occasioned thereby to be borne solely by the Contractor.

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§ 3.18.7 The Contractor shall further indemnify and hold harmless the Indemnitees from and against any costs and expenses (including reasonable attorneys' fees) incurred by any of the Indemnitees in enforcing any of the Contractor's defense, indemnity, and hold harmless obligations under this Section 3.18 or as may otherwise be provided elsewhere in the Contract.

§ 3.18.8 Subject to Section 3.18.9, all obligations of the Contractor under this Section 3.18 to defend the Indemnitees are obligations to provide full defenses at the sole cost and expense of the Contractor, regardless of any alleged culpability on the part of any Indemnitee or any ultimate determination of relative shares of liability of any Indemnitee or limitation of the Contractor's indemnity obligations in light of such determination.

§ 3.18.9 To the extent any defense, indemnity, or hold harmless obligations under this Section 3.18 are made void or otherwise impaired by any law controlling their construction (including but not limited to laws limiting such obligations to the extent of the portion of damages caused by an indemnitor), such obligations shall be deemed to conform to the greatest rights to defense and indemnity permitted by such law (including but not limited to New York State General Obligations Law Section 5-322.1).

§ 3.18.10 All provisions of this Section 3.18 shall survive termination of the Agreement or final completion. No obligations under this Section 3.18 shall be construed to negate, abridge, or reduce other rights or obligations to defense and indemnity, including but not limited to common law indemnity, which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.19 Existing Features and Underground Data

§ 3.19.1 The location of existing features shown on plans is intended for general information only. The Contractor, alone, is responsible for accurate determination of the location of all structures, and shall not be entitled to any increase in the Contract Sum or Contract Time due to difficulties or distances encountered in the Work, which should have been foreseeable thereby.

§ 3.19.2 The locations, depths and data as to underground conditions have been obtained from records, surface indications and data furnished by others. Information furnished is solely for the convenience of the Contractor without any warranty, expressed or implied as to its accuracy or completeness. The Contractor shall make no claim against the Owner, Construction Manager or Architect with respect to the accuracy or completeness of such information if it is erroneous, or if the conditions found at the time of construction are different from those as indicated.

§ 3.20 Construction Stresses

§ 3.20.1 The Contractor shall be solely responsible for the conditions which develop during construction and in the event any structure is dislocated, over strained, or damaged so as to affect its usefulness, the Contractor shall be solely responsible. The Contractor shall, at its own expense, take whatever steps necessary to strengthen, relocate, or rebuild the structure to meet all applicable requirements.

§ 3.20.2 The Contractor is responsible for restoration and repair of utilities, private property, buildings, pavement, walkways, roads, or other property damaged by its activities under its Contract.

§ 3.21 Training and Instructions

§ 3.21.1 Upon Substantial Completion of the Work, the Contractor shall orient and instruct personnel of the Owner designated by it in the operation and maintenance of all equipment furnished by the Contractor and shall turn over all pertinent literature and operational manuals relating to the equipment. The format for organizing, binding, and delivering such manuals shall be as described in the Specifications. All Owner training sessions to be video recorded by the Contractor and digital copies provided to the Owner upon closeout for the Owner's future use.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 4.1 General

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

§ 4.1.2 The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment and during the correction period described in Article 12. The Construction Manager and Architect have the authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project Schedule. The Contractor shall participate with other Contractors and the Construction Manager, the Architect and Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall constitute the schedules to be used by the Contractor, other Contractors, the Architect, the Construction Manager and the Owner until subsequently revised.

§ 4.2.4.1 The Contractor will assume full responsibility for the execution of its Work in the allotted duration times set forth in the Project Schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

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§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

§ 4.2.10 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data, and Samples. Where there are other Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.11 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.12.1 The Architect's review of Contractor's submittals shall be limited to an initial submittal and one (1) resubmittal. If the Architect is required to review additional submittals because the initial submittal and resubmittal failed to conform to the information given and the design concept expressed in the Contract Documents, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the payments to the Contractor.

§ 4.2.12.2 The review will not be considered complete until an "ACTION" stamp or other written notice to that effect has been received by the Contractor.

§ 4.2.13 The Construction Manager will prepare Change Orders, Allowance Disbursements and Construction Change Directives.

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§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7 and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.15 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.17 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such Project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

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

§ 4.2.19 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor.

§ 4.2.19.1 If Work is described or indicated in a manner which makes it impossible to carry out the requirements of the Contract Documents, or should discrepancies appear among the Contract Documents, the Contractor shall request interpretation before proceeding with the Work. If the Contractor fails to make such a request, no excuse will be entertained for failure to carry out the Work of the Contract Documents. Should a conflict occur in or between Contract Documents, the Contractor is deemed to have included in the Contract Sum the more expensive manner of doing the Work.

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

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within ten (10) days after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager or the Architect has reasonable objection to any such proposed person or entity or, (2) that the Construction Manager, Architect or Owner requires additional time for review. Failure of the Construction Manager, Owner, or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.1.1 In no case shall payments be made on the Contract until a complete list of Subcontractors has been submitted by the Contractor to the Construction Manager for review by the Owner, Construction Manager, and Architect. Such list shall not be considered complete if the Owner, Construction Manager or Architect has any reasonable objection to any name listed thereon. Such list shall be submitted and resubmitted if necessary until it is considered complete.

§ 5.2.1.2 Subcontractors will not be acceptable unless, when requested by the Owner, Architect or Construction Manager, evidence is furnished by the Contractor that the proposed Subcontractor has satisfactorily completed similar subcontracts as contemplated under this Contract, and has the necessary experience, personnel, equipment, plant and financial ability to complete the proposed subcontract in accordance with the intent of the Contract Documents and the Project Schedule. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

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

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager and Architect have no objection.

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

§ 5.2.5 The Maintenance of the Project Schedule is critical. The Contractor shall award subcontracts to entities capable of performing in a manner that will maintain the Project Schedule and require its subcontractors to complete their work in accordance with the Project Schedule.

§ 5.2.6 Upon written request from or on behalf of the Owner, the Contractor shall provide to the Owner executed, unredacted copies of all subcontracts, purchase orders or other agreements relating to the Work.

§ 5.3 Subcontractual Relations

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

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Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. Each subcontract shall contain provision for execution of lien waivers in form and substance acceptable to the Owner as a condition of payment by the Contractor. The Contractor shall require each Subcontractor to (1) inspect the Project site, including all relevant surfaces and job conditions, before beginning the Work and (2) accept or cite necessary corrections in the Project site, including surfaces or job conditions, before beginning the Work.

§ 5.3.2 The Contractor shall promptly notify the Owner and Architect of any material defaults by any Subcontractor and whether it has terminated its agreement with any of its Subcontractors for any reason.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner pursuant to Article 14 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

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

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

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 60 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation..

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

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

§ 6.1.4 The Contractor accepts assignment of, and liability for, all purchase orders and other agreements for procurement of materials and equipment that are identified as part of the Contract Documents. The Contractor shall be responsible for such pre-purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation and testing of items covered in any assigned purchase orders or agreements. All warranty and correction of the Work obligations under the Contract Documents shall also apply to any pre-purchased items, unless the Contract Documents specifically provide otherwise.

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§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor recognizes and acknowledges that the Project is governed by and subject to the provisions of New York State General Municipal Law §101, et seq., governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other Contractors or Separate Contractors will be performing work on the project in conjunction with it. As such, the Contractor shall afford the Owner's own forces and other Contractors or Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.1.1 The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other Contractor or Separate Contractor performing work on the Project. If the Contractor sustains any damage through any act or omission of Separate or other Contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a subcontractor of such Separate or other Contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage

§ 6.2.1.2 The Contractor agrees to defend and indemnify Owner, Architect, Construction Manager, Consultants and Sub-consultants, from all claims made against any of them arising out of the Contractor's acts or omissions or the acts or omissions of any subcontractor of the Contractor which have caused damage to the Owner, Architect, Construction Manager, Separate Contractor or other Contractor on the project. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the contract or by law. Further, the Owner shall withhold from the Contractor's Contract Sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

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

§ 6.2.2.1 The Contractor shall promptly correct discrepancies or defects in its Work identified by Separate Contractors as affecting proper execution and results of the work of the Separate Contractors.

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

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

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

§ 6.2.6 Should the Contractor or its Subcontractors cause damage to the work or property of any Separate Contractor or other Contractor, the Contractor shall, upon due notice, promptly attempt to settle by agreement or otherwise resolve the dispute with the Separate Contractor or other Contractor. If such separate trade contractor or other Contractor sues or makes any other claim against the Owner, Construction Manager, or Architect on account of any damage alleged to have been caused by the Contractor or its Subcontractors, the Contractor shall defend, indemnify, and hold harmless the Owner, Construction Manager, and Architect against such claim or proceedings at the Contractor's own expense. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the Contract Documents or by law. Further, the

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Owner shall be entitled to withhold from the Contractor's Contract Sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

§ 6.2.7 When the Work of the Contractor or its Subcontractors overlap or dovetail with that of other Contractors, materials shall be delivered and operations conducted to carry on the Work continuously, in an efficient, workmanlike manner.

§ 6.2.8 In case of interference between the operations of the Contractor and other Contractors, the Construction Manager will be the sole judge of the rights of each contractor and shall have the authority to decide in what manner the Work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the Work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

§ 6.2.9 The Contractor, including its Subcontractors, shall keep itself informed of the progress of other Contractors and shall notify the Architect or the Construction Manager immediately in writing of lack of progress on the part of other Contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the Project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's Work.

§ 6.2.10 Delays or oversights on the part of the Contractor or its Subcontractors in getting any or all of the Work done in the proper way, thereby causing cutting, removing and replacing Work already in place, shall not be the basis for a claim for extra compensation.

§ 6.2.11 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner, Separate Contractor or other Contractor, the Contractor shall, prior to proceeding with that portion of its Work, promptly report to the Architect and Construction Manager apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to report such condition shall constitute an acknowledgment that the Owner's, Separate Contractor's or other Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work.

§ 6.2.12 The Contractor shall promptly correct discrepancies or defects in its Work which have been identified by Separate Contractor(s) or other Contractor(s) as affecting proper execution and results of the work of such Separate Contractor(s) or other Contractor(s).

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, only by Change Order, Construction Change Directive or field order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. The Owner may in its sole discretion deduct or reduce the scope of the Contractor's Contract with or without any specific reasons therefor.

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

§ 7.1.2.1 Field orders are an interpretation of the Drawings or Specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contract Sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of the Contract

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Time. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its Work or the work of other Contractors or Separate Contractors engaged by the Owner in connection with the Project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or field order for a minor change in the Work. Additional work performed without authorization of a Change Order will not entitle the Contractor to an increase in the Contract Sum or an extension of the Contract Time. No course of conduct or prior dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is, in fact, any unjust enrichment of the Owner, shall be the basis for any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.

§ 7.1.4 Costs for changes in the Work shall not be allowed in excess of usual rentals charged in the area where the Project is located for similar equipment of like size and condition, including costs of necessary supplies and repairs for operating equipment on site in connection with other work unless its use incurs actual and additional costs to Contractor. If equipment not on Site is required for change in work only, cost of transporting equipment to and from Site will be allowed.

§ 7.1.5 When the Owner or Architect (in association with the Construction Manager) request that the Contractor perform work which is not included in the Contract Drawings or Specifications and which will result in additional cost to the Owner, the Architect shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and Architect for review. The Contractor's proposal shall include a complete itemization of the costs associated with performing its work including labor and materials. All proposals for any work that a Contractor, its Subcontractor(s) or Sub-subcontractor(s) perform in connection with additional work shall be properly itemized and supported by sufficient substantiating data, including but not limited to material descriptions, material quantities, material unit prices, labor trade listings, labor hour quantities, labor trade rates, equipment descriptions and equipment rates with a percentage allowance for overhead and profit as set forth in Section 7.3.11.

§ 7.1.6 Overtime, when specifically authorized by the Owner in writing, and not as a corrective measure by the Contractor to expedite the progress of construction as ordered by the Owner based on its determination that the performance of the Work has not progressed to the level of completion required by the approved Schedule, shall be paid for by the Owner on the basis of premium payment only, plus the cost of insurance and taxes based on the premium payment period. Overhead and profit will not be paid by the Owner for overtime.

§ 7.1.7 Costs to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4. The allowable overhead and profit mark-up shall include, but not be limited to, the following:

- **.1** home office expense;
- **.2** field office expense;
- **.3** supervision;
- **.4** project management & estimation; and
- **.5** small tools & equipment.

§ 7.1.8 Unit prices shall be submitted in the Bid Form for various items as set forth therein, and are subject to approval and acceptance by the Owner. The Owner reserves the right to reject any unit price which is unreasonable or unbalanced, as compared with prevailing costs, or as compared with the unit prices submitted by other bidders for the Project. Approved unit prices quoted shall include all profit, overhead, bonds, insurance, labor, materials, equipment, tools, applicable taxes necessary to complete the work item and shall apply to all work added or work deducted.

§ 7.2 Change Orders

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

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and

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.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.1.4 Changes in the Work involving additional Work or deletion of Work effecting an addition to or subtraction from the Contract Sum shall not be made until the Contractor submits to the Architect and Construction Manager the cost of the added or deleted Work with a complete and detailed listing of all Subcontractors involved, all materials, labor, overhead and profit and an appropriate Change Order has been issued. If requested, the Contractor shall submit detailed quotations for Subcontractors and material suppliers. Changes in the Work when not involving additions or deletions from the Contract Sum shall not be made until the Architect has issued an appropriate Change Order. All Change Orders must have the approval of the Owner, Construction Manager and Architect in writing.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.2.3 Agreement on any Change Order shall constitute a final settlement of all Claims and other matters related to the change in Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change (including, without limitation, all costs of associated delay, interference, acceleration, inefficiency, overhead, as well as costs of material, labor and supervision), and any and all adjustments to the Contract Sum and the Contract Time. Payment of a Change Order shall constitute accord and satisfaction of all Claims of the Contractor in connection with the change or changes to the Contract addressed by the Change Order and it is understood and agreed that a signed Change Order shall be the complete and fully integrated agreement for all related costs and there are no oral or written understandings, reservations, representations or agreements, directly or indirectly, connected with the Change Order and not affirmatively stated on the signed Change Order. In the event a Change Order increases the Contract Sum, the Contractor shall include the Work covered by such Change Orders in Applications for Payments as if such Work were originally part of the Contract Documents.

§ 7.2.4 Upon the Contractor's completion of the Change Order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

.1 Certified payrolls itemizing the labor actually utilized in connection with the Change Order work; and

.2 Copies of invoices from its Subcontractors supplying work in connection with the Change Order work.

§ 7.2.5 Additional work performed without authorization of a Change Order will not entitle the Contractor to an increase in the Contract Sum or an extension of the Contract Time, except at provided in Section 7.3, and except in the case of an emergency as provided in Section 10.4.

§ 7.3 Construction Change Directives

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

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order. In the event the Contractor and the Owner cannot agree on the sum by which the Contract Sum or the amount of time by which the Contract Time is to be increased or reduced based upon changes to the scope of the Work as described in Article 7, the Architect or Construction Manager shall issue a Construction Change Directive reflecting the increase or reduction of the scope of the Contractor's Contract.

§ 7.3.2.1 If the Owner and the Contractor cannot agree that the requested Work properly forms the basis for a Change Order or on the sum by which the Contract is to be increased or reduced based upon changes to the scope of Work, the Architect shall issue a Construction Change Directive signed by the Owner, Construction Manager and Architect reflecting the addition to, or deduction of, the scope of Work and the Contractor shall (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the Work of the Contractor or other Contractors working at the site and keep records of its performance of such additional work, and (b) in the case of work to be deducted from the scope of the Contractor's Work, refrain from taking any steps in connection with the work associated with the deduction of the Contractor's Work. The Construction Change Directive shall include: (a) a description of the work being added or deducted from the Contractor's scope of Work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction of the scope of the Contractor's Contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's

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Contract Sum, or until a claim filed by the Contractor has been determined; and (c) the extent to which the Contract Time will be adjusted as a result of the change in the scope of Work. Any claims must be filed in accordance with the requirements set forth in Article 15 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

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

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon (unit prices shall be deemed to include all costs and expenses for the Contractor's changed Work, including costs of general conditions, insurance/bonds and overhead and profit attributable to the change);
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee subject to the limitations of Section 7.3.11; or
- **.4** As provided in Section 7.3.4 subject to the limitations of Section 7.3.11.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.11, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Actual costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
- **.2** Actual costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** Actual rental costs of machinery and equipment, exclusive of hand tools, rented from third parties; and
- **.4** Actual costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the additional work.

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

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. Any claims must be filed in accordance with the requirements set forth in Article 15 of these General Conditions. Failure to timely file any claim in strict accordance with requirements set forth therein shall constitute a waiver of such claim.

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

§ 7.3.8 When the Owner or Architect request that portions of the Contractor's Work originally included in the Drawings or Specifications be deleted and which will result in a reduction of the Contract Sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such Work from the Contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such Work including labor, materials, overhead and profit. The Contractor shall not be entitled to retain its overhead and profit for such work nor shall any of its subcontractors which were to perform the work being deducted from the Contractor's scope of Work. Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

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

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

§ 7.3.11 The limit for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces, fifteen percent (15%) of the direct cost for labor and materials.

.2 For the Contractor, for Work performed by the Contractor's Subcontractor, maximum of five percent (5%) of the amount due the Subcontractor for the Contractor's overhead and profit. For the Subcontractor, for Work performed by the Subcontractor's own forces, ten percent (10%) of the direct cost for labor and materials. The total combined overhead and profit for a change order shall be limited to 15% of the direct cost regardless if the Work is performed by the Contractor or the Subcontractor.

.3 The markup on any part of the Work a Subcontractor subcontracts will be limited to one overhead and profit figure, in addition to the Contractor's overhead and profit markup. The Subcontractor and Sub-subcontractor may divide the overhead and profit amount as they agree upon.

.4 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

.5 In order to facilitate checking of quotations for extras and credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and subcontracts. Labor and material shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also.

.6 Overhead and profit mark-up shall include, but not be limited to, the following:

- **.1** home office expense;
- **.2** field office expense;
- **.3** supervision;
- **.4** project management & estimation; and
- **.5** small tools & equipment.

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed or extended by the failure to act of the Contractor or persons or entities for whom the Contractor is responsible to act.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8. The date of final completion is the date certified by the Architect and Owner in accordance with Section 9.10. Unless

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otherwise agreed in writing by the Owner, the Contractor agrees that final completion shall occur not more than 30 calendar days after the date of Substantial Completion.

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

§ 8.1.5 Work remaining to be completed after Substantial Completion, shall be limited to items which can ordinarily be completed within a thirty (30) day period (one month) before final payment is made.

§ 8.2 Progress and Completion

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner and the Owner's approval of such insurance. The date of commencement of the Work shall not be changed by the effective date of such insurance. The Work can not start until the required insurance and bonds are provided and the Contract has been executed.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion and final completion within the Contract Time. The Contractor agrees that the Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will insure full completion thereof within the Contract Time specified and, further, to provide such protections as may be necessary. It is expressly understood and agreed by the Contractor that the time for the substantial and final completion of the Work is a reasonable time for its completion, taking into consideration, among other things, the average climatic range and usual weather conditions prevailing in the Project's locality.

§ 8.2.4 In no case shall the Contractor delay the progress of the Work, or any part thereof, on account of changes in the Work or disputes caused by proposed or ordered changes in the Work (including the equitable value of the changes), or any disputes or disagreements as to the Work or extra work.

§ 8.2.5 The Contractor recognizes that achieving Substantial Completion and final completion of the Work in accordance with the time limits set forth in the Agreement and as further set forth in the Milestone Schedule provided in the Project Manual are material conditions of this Agreement, and that if the Contractor fails to achieve Substantial Completion and final completion of the Work in accordance with such schedule, the Owner will incur damages as a result. The Owner and Contractor agree that the amount of such damages is difficult to ascertain with any precision. The Contractor and Owner have attempted to estimate reasonable daily figures for liquidated damages, not to penalize the Contractor for late completion, but to reasonably estimate probable losses and damages to the Owner in the event of the late completion. If the Contractor does not achieve the completion date and milestone date for each Work item in the Contract, a milestone or critical path date reflected on the Project Schedule, or the date of Substantial Completion or final completion for the Work or any part thereof, liquidated damages will be assessed in the amount of $1,000.00 for each and every calendar day after such time allowed for completion until Substantial Completion or final completion actually occurs.

§ 8.2.5.1 The Contractor realizes that time is of the essence on this Contract and the Substantial Completion date and final completion date for each Work item in its Agreement, a Milestone Date reflected on the Project schedule, or the date of Substantial Completion or final completion of the Contractor's Work shall be no later than the date indicated therein. In the event the Contractor fails to complete any Work or substantially complete the Work by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of the Contract Time in accordance with the provisions of the Contract Documents.

§ 8.2.5.2 The said sum per calendar day shall constitute the liquidated damages incurred by the Owner for each day of delay beyond the agreed upon dates of Substantial Completion or final completion. The foregoing liquidated damages are intended to compensate the Owner only for the loss of beneficial use of the Work of the Contract. In the event the Contractor fails to complete all Work under this Contract by said scheduled dates, in addition to the liquidated

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damages incurred by the Owner in connection with the Contractor's delay, to the fullest extent permitted by law, the Contractor shall be liable for all costs incurred by the Owner for additional services provided by the Architect and Construction Manager, as well as liabilities to other Contractors and Separate Contractors working on the Project.

§ 8.2.5.3 The Owner's right to liquidated damages shall survive abandonment of the Work by the Contractor or the Owner's termination of the Contract.

§ 8.2.5.4 Notwithstanding the foregoing, if one or more of the liquidated damages provisions set out in the Agreement are held to be legally unenforceable as a penalty, the Owner shall be allowed to recover actual damages caused by the Contractor's failure to achieve the applicable Contract Time requirements.

§ 8.2.6 The Contractor understands that in order to meet the requirements of the Project schedule, including intermittent milestone and critical path dates set forth in the Contract Documents, it may be required to work its personnel and equipment overtime on regular work days and on Saturdays and holidays, the cost of which is included in the Contract Sum. If the Owner specifically approves in writing reimbursement for overtime, the Contractor shall be paid by the Owner on the basis of the premium payment.

§ 8.2.7 The Owner shall have the right at any time to modify the Project Schedule; to suspend, delay or accelerate, in whole or in part, the commencement or execution of the Work or any potion thereof or to vary the sequence thereof; and to prescribe the time, order and priority of the various portions of the Work, and all other matters relating to the scheduling of the Work. The Contractor shall not be entitled to additional compensation for any such decisions made by the Owner.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed in the commencement or progress of the Work as a result of: Acts of God (such as tornado, flood, hurricane, pandemics, epidemics, etc. making performance temporarily impossible); the negligent acts or omissions of the Owner, Architect, Construction Manager, other Contractors, or their agents or employees; strikes, lockouts or other labor disturbances (not arising from the labor practices of the Contractor or its Subcontractors, Suppliers, or Sub-subcontractors to comply with their obligations arising under the Contract); unusually adverse weather conditions; freight embargoes (provided that delays by the Contractor, its Subcontractors, Sub-subcontractors or Suppliers do not constitute an excusable cause of delay); changes in the work to be performed by the Contractor (not caused or resulting from the failure of the Contractor or its Subcontractors, Suppliers or Sub-subcontractors); or changes to laws or regulations after the effective date of the Contract; provided the Contractor has used all reasonable efforts to mitigate the foregoing causes; then the Contractor shall be entitled to a day for day extension of the Contract Time for the established delay to the critical path of the Work subject to the provisions of this Article 8 and Article 15. All other delays of the Project, including but not limited to: Architect review or approval of shop drawings, other submittals, requests for information, clarifications, samples, and change orders; the Owner schedule; Architect certification of payment; payment by the Owner of Contractor's Application for Payment; coordination among the Multiple Prime Contractors; unavailability of materials or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and contemplated and, therefore shall not form the basis for a claim for an extension of time or additional compensation by the Contractor.

§ 8.3.1.1 The Contractor further acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay (1) is not caused or could not have been anticipated by the Contractor, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay or reasonable likelihood that a delay will occur, and (3) is of a duration of more than one (1) day.

§ 8.3.1.2 The Contractor's inability to secure sufficient personnel for the performance of the Work shall not constitute a basis for an extension of time. The Contractor shall not be entitled to an extension of time if the Architect or Construction Manager stops the Work due to the existence of or reasonable suspicion of a deficiency in the Work.

§ 8.3.1.3 An extension of the Contract Time, if requested by the Contractor, shall only be considered after the Contractor has made reasonable effort to recover the lost time. An extension, or extensions, of time may be granted subject to the provisions of this Article 8, but only after written application therefore by the Contractor. An extension of time shall be only for the number of days of delay which the Architect may determine to be due solely to the causes set forth in the application for extension of time. The Contractor shall not be entitled to receive a separate extension of

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time for each one of several causes of delay operating concurrently; but if at all, only the actual period of delay as determined by the Construction Manager or Architect.

§ 8.3.1.4 All requests for additional time shall be made in writing, delivered to the Construction Manager within five (5) days from the time when the circumstance with potential for delay becomes reasonably known to the Contractor, supported by documentation which demonstrates to the Architect and Construction Manager's satisfaction that the critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the Project at no cost. This request shall also contain, at a minimum, the following information: (1) date of start of delay; (2) specific cause of delay; (3) effect of delay on construction progress; and (4) date of termination of delay. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's Work when in its judgment such an extension is justified. The Owner's determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its Work shall be memorialized by written change order, signed by the Owner, Contractor, Architect and Construction Manager. When the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following: for each day of delay in the completion of its Work, the Contractor shall be allowed one day of additional time to complete its Contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently; rather, only the actual period of delay as determined by the Owner or its Architect may be allowed.

§ 8.3.1.5 Failure of the Contractor to give written notice as required by Section 8.3.1.4 or to strictly comply with the requirements of Article 8 shall be deemed conclusively to be a waiver and release of such claim, and such notice shall be a condition precedent to the Contractor's right to make a claim for any claim arising out of, under or in connection with the Contractor or the performance of the Work.

§ 8.3.2 Notwithstanding anything to the contrary in the Contract Documents, an extension in the Contract Time, to the extent permitted and justified under Section 8.3.1, shall be the sole remedy of the Contractor for, and the Contractor waives its right to any claim for damages to the extent arising from, any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; or (4) other claims for disruption, interference, inefficiencies, impedance, hindrance, acceleration, resequencing, schedule impacts, lack of timeliness by the Owner or its consultants, and lack of coordination, errors or omissions in the design of the Project, cumulative impact of multiple change orders, delay and other impacts (collective referred to herein as "Delay(s)"). In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delay, including, but not limited to, delay costs, loss of productivity or efficiency, lost profits, extended jobsite general conditions and home office overhead, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as interference, hindrance or obstruction with the Contractor's performance of the Work and shall not entitle the Contractor to any additional compensation. The Contractor shall include a no-damages-for-delay clause in all subcontracts for the performance of the Work.

§ 8.3.3 Delays that affect the scheduled completion of the Work and are attributable to interference between other Contractors, Separate Contractors, Subcontractors, Suppliers, utility companies or municipalities, shall be compensated solely by the granting of an extension of time to the Contractor by the Owner to complete the Work without charges to the Owner. The parties acknowledge that the Contract Time accounts for and contemplates the time necessary for: review of submittals and shop drawings; correcting design errors or omissions; coordination among the Contractor, other Contractors and Separate Contractors; change orders; delays incurred by seasonal limitations; and other administrative processing by all parties involved and are not compensatory. The Contractor agrees that it has included in its Bid prices the additional cost of doing work under this Contract caused by interference of the Architect, Construction Manager, other Contractors, Separate Contractors, Subcontractors, etc. and the other non-compensatory Delays described above.

§ 8.3.4 When the Contract Time has been extended, as provided under Section 8.3, such extension of time shall not be considered as justifying extra compensation to the Contractor for administrative costs, home office, estimating, extended general conditions or other similar impact costs. The Contractor acknowledges that in agreeing to the

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Contract Sum it assessed the potential impact of the limitations in Section 8.3.2 on its ability to recover additional compensation in connection with a Work delay, interference, impact or hindrance and agrees that those limitations shall apply regardless of the accuracy of the Contractor's assessment or actual costs incurred by the Contractor.

§ 8.3.5 If the Contractor submits a progress report indicating, or otherwise expresses an intention to achieve, completion of the Work prior to any completion date required by the Contract Documents or expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

§ 8.3.6 The intent of the Contract is for Work to follow a logical sequence. The Contractor, however, may be required by the Owner, Construction Manager or Architect to temporarily omit or leave out any section of Work or perform Work out of sequence. Out of sequence work and come back time to these areas shall be performed at no additional cost to the Owner.

§ 8.3.7 Claims relating to Contract Time shall be made in accordance with applicable provisions of Article 15.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. Notwithstanding anything to the contrary contained in the Contract Documents, the Owner may withhold or offset any payment to the Contractor if and for so long as the Contractor fails to perform any of its obligations under any of the Contract Documents; provided, however, that any such holdbacks shall be limited to an amount sufficient in the reasonable opinion of the Owner to cure any default or failure of performance by the Contractor.

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

§ 9.2 Schedule of Values

§ 9.2.1 Within ten (10) days of Notice of Award, the Contractor shall submit to the Construction Manager, for review and approval by the Architect and Construction Manager, a schedule of values allocated to various portions of the Work for each building, prepared in the currently authorized form of AIA Document G703 – Continuation Sheet and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. The schedule of values shall conform to the requirements of Specifications Section 01 29 00 – PAYMENT PROCEDURES. This schedule of values, if approved by the Construction Manager and Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.2.2 Any schedule of values that fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's Work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or Architect to be improper for any reason, sufficient funds shall be withheld from the Contractor's future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's Work.

§ 9.3 Applications for Payment

§ 9.3.1 At least 15 days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, notarized and reflecting retainage as provided elsewhere in the Contract Documents. Applications for Payment will be in the currently authorized form of AIA Document G732 - 2019, "Application and Certificate for Payment," accompanied by AIA Document G703-1992, "Continuation Sheet," and must include (add or deduct) adjustments to the Contract Sum resulting from Work performed under approved change orders (specified under Article 7) and shall be shown separately on the application for previous and current periods. Each Application and Certificate of Payment shall be accompanied by two (2) copies of the Pay Application Lien Waiver and Release in the form set forth in Specifications Section 01 29 00 – PAYMENT PROCEDURES or otherwise required by the Owner. Each Application for Payment shall be prepared in such form and supported by such data to substantiate the Contractor's right to payments as the Owner, Construction Manager or Architect may require such as copies of requisitions from Subcontractor and

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material suppliers. Each Application for Payment forwarded to the Owner by the Construction Manager or Architect shall be subject to audit and approval by the Owner in accordance with the Owner's normal audit.

§ 9.3.1.1 The Construction Manager and Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager or the Architect may make such adjustments under the circumstances set forth in Section 9.5.1. If any such adjustments are made by the Architect or Construction Manager, the Contractor shall submit an original itemized revised application with all documentation required by Section 9.3.1.

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

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

§ 9.3.1.4 Until Substantial Completion, the Owner shall pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments, less an amount necessary to satisfy any claims, liens or judgments against Contractor, which have not been suitably discharged. In accordance with Section 9.8.5, the Owner shall pay the entire amount retained from previous progress payments less two (2) times the amount required to complete items identified in a list prepared in accordance with Section 9.8.2 and the amount required to satisfy any outstanding claims, liens, or judgments against the Contractor.

§ 9.3.1.5 The Contractor and its Subcontractors are required to submit certified payroll and OSHA 10 information monthly with Application for Payment to the Owner in accordance with New York State Law.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the Project site for subsequent incorporation in the Work. If approved in advance in writing by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest. The costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site shall not increase the Contract Sum.

§ 9.3.2.1 Payment may be made for materials and equipment delivered and suitably stored on-site for future incorporation in the Work, subject to the following conditions:

.1 Request for payment shall be considered for material or equipment, which is in short or critical supply, which has been specially fabricated for the Project or, at the discretion of the Construction Manager and Architect, for other materials or equipment.

.2 A request for payment of material stored on-site must be made by the Contractor ten (10) days prior to actual, monthly cut-off date for Payment Applications.

.3 Procedures required by the Owner shall include, but not necessarily limited to, submission by the Contractor to the Construction Manager and Architect of bills of sale and bills of lading for such materials and equipment, provisions of opportunity for the Construction Manager's and Architect's visual verification that such materials and equipment are in fact in storage; and, if stored off-site, submission by the Contractor of verification that such materials and equipment are stored in a bonded warehouse.

.4 All such materials and equipment, including materials and equipment stored on-site but not yet incorporated into the Work, upon which partial payments have been made shall become the property of the Owner, but the care and protection of such materials and equipment shall remain the responsibility of the Contractor until incorporation into the Work and accepted by the Owner at substantial completion, including maintaining insurance coverage on a replacement cost basis without voluntary deductible.

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§ 9.3.2.2 Payment may be made for materials and equipment delivered and suitably stored off-site for future incorporation in the Work, subject to the following conditions:

.1 The Contractor shall submit: a written validation by the Owner, Construction Manager or Architect that such materials are stored safely off site, in the quantities and condition stated by the Contractor; a copy of an invoice for the material and equipment; a bill of sale or equivalent indication of the quantity and value of the material or equipment; a written statement indicating the location and method of storage; and property insurance certificate or rider covering the specific material or equipment, which shall name the Owner as an additional insured party.

.2 The Contractor shall submit a verification that such materials and equipment are stored in a bonded warehouse.

.3 A request for payment of material stored off-site must be made by the Contractor ten (10) days prior to actual, monthly cut-off date for Payment Applications.

.4 All such materials and equipment upon which partial payments have been made shall become the property of the Owner, but the care and protection of such materials and equipment shall remain the responsibility of the contractor until incorporation into the Work and accepted by the Owner at substantial completion, including maintaining insurance coverage on a replacement cost basis without voluntary deductible.

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

§ 9.3.4 The Contractor further expressly undertakes to defend the Indemnitees (as defined previously in Section 3.18), at the Contractor's sole expense, against any actions, lawsuits or proceedings brought against Indemnitees as a result of liens filed against the Owner, the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor or any portion of the property of any of the Indemnities (referred to collectively as liens in this Section 9.3.4). The Contractor hereby agrees to defend, indemnify and hold Indemnitees harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such actions, lawsuits or proceedings.

§ 9.3.5 The Owner shall release any payments withheld due to a lien or a claim of lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less than One Hundred Fifty percent (150%) of such lien claim. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under this Section 9.3, including, without limitation, the duty to defend and indemnify the Indemnities in an action on the lien, lien discharge bond or underlying debt. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.4 Certificates for Payment

§ 9.4.1 The Construction Manager will, within seven (7) days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven (7) days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there is more than one Contractor performing portions of the Project, the Construction Manager will, within seven (7) days after the Construction Manager receives all of the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Contractor's

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application with information from similar applications for progress payments from the other Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven (7) days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.3 The Construction Manager's certification of an Application for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Construction Manager or Architect.

§ 9.4.6 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

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.5 damage to the Owner, other Contractor or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
.7 failure to carry out the Work in accordance with the Contract Documents;
.8 receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the Project;
.9 failure to comply with applicable federal, state or local statutes, regulations, or laws, including, without limitation, laws and regulations applicable to the provision of certified payrolls;
.10 failure of the Contractor to provide executed performance and payment bonds and a current certificate of insurance and endorsements;
.11 reasonable evidence that the Work has not progressed as indicated on the Application for Payment;
.12 damages caused to the Owner, Construction Manager, the Architect or other Contractor as a result the Contractor's performance of its Work;
.13 the Architect's or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective or incomplete;
.14 The amount requested exceeds the percent completion of Work on the site; or
.15 breach of this Agreement.

Notwithstanding the extent to which the Construction Manager or Architect certify an Application for Payment, the Owner shall have the right to withhold payment, in whole or in part, should the Owner determine that any of the grounds for withholding certification set forth in this Section 9.5.1 do in fact exist. If the Owner withholds payment, in whole or in part, the Owner shall promptly provide to the Contractor, Architect and Construction Manager a written explanation of the reason(s) for which payment is withheld and shall promptly pay, in accordance with the Contract Documents, all amounts which are not in dispute.

§ 9.5.2 If the Contractor disputes any determination by the Owner, Construction Manager or Architect with regard to any Certificate for Payment, or in the event of a bona fide dispute between the Contractor and the Owner, the Contractor nevertheless shall expeditiously continue to prosecute the Work and may submit a Claim in accordance with Article 15.

§ 9.5.3 When the above reasons for withholding certification or the Owner's withholding of payment are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, or if the Owner otherwise deems it necessary to protect its interests or the interests of the Project, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

§ 9.5.5 Notwithstanding anything above to the contrary, the Owner has the right to withhold payment to the Contractor to protect itself against damages incurred or which may be incurred as a result of the Contractor's breach or negligence, including, but not limited to, the items set forth in Section 9.5.1. With respect to any liens, claims, or other circumstances for which the Owner is entitled to withhold payments pursuant to decisions by the Architect pursuant to Section 9.5.1, the Owner shall be entitled to withhold a sum equal to twice the stated amounts of such liens or claims, or, where there is no stated amount, twice the amount determined by the Architect to be necessary to protect the interests of the Owner. The Owner will release payments withheld due to liens provided that the Contractor obtains a discharge of record of such lien, by bonding or otherwise. By posting a lien discharge bond, however, the Contractor shall not be relieved of any responsibilities or obligations under the Agreement, including, without limitation, the duty to defend, indemnify, and hold harmless the Indemnitees (as defined previously in Section 3.18). The cost of any premiums or other expenses incurred in connection with such bonds or other means of discharge of record shall be the sole responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.5.6 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract, including but not limited to these General Conditions, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct

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defective work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents unless such requisition is not in accordance with the terms of the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.2 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held in trust by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contracts with the Contractor for which payment was made by the Owner. The Contractor shall strictly comply with any common law, statutory, or decisional law trust fund requirements in the State of New York (including, without limitation, the requirements of New York Lien Law Article 3-A), and hereby agrees that the Owner has the same rights as any beneficiary of such trusts to examine the books and records of the Contractor to determine such compliance, from time to time at the Owner's sole discretion. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

§ 9.6.2.1 Within seven (7) days of receipt of a payment from the Owner, the Contractor shall pay each of its Subcontractors and suppliers for work performed and materials furnished by them as reflected in the payment from the Owner, less an amount necessary to satisfy any outstanding claims, liens, or judgments and less a retained amount of not more than 5%, except that the Contractor may retain not more than 10% provided that prior to entering into a Subcontract with the Contractor, the Subcontractor is unable or unwilling to provide a performance bond and labor and material payment bond both in the full amount of the subcontract at the request of the Contractor. The Contractor shall not retain portions of the proceeds owed any Subcontractor or supplier from the Owner's payment to the Contractor for the "contract balance." Similar provisions apply to the Subcontractor and supplier paying each of its Subcontractors and suppliers. Nothing in this Section shall create in the Owner any obligation to pay, or to ensure that the Contractor pays, any Subcontractor or supplier, or any relationship in contract or otherwise, implied or expressed, between any Subcontractor or supplier and the Owner. The Contractor agrees that it shall comply with the payment requirements of Section 106-b(2) of the New York General Municipal Law, as amended, and that to the extent there is any conflict between that statutory section and the provisions of this Section 9.6.2.1, the provisions of the statute shall prevail.

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

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

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

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

§ 9.6.7 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both,

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under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

(Paragraph deleted)

§ 9.7 Failure of Payment

If, through no fault of the Contractor, the Owner does not pay the Contractor the amount certified by the Construction Manager and Architect, subject to the Owner's right to withhold payment under the terms of the Contract Documents, within 30 days of the date established for such payment in the Contract Documents, then the Contractor may, upon seven (7) additional days' written notice and opportunity to cure to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. To the extent it is determined that payment to the Contractor was improperly held through no fault of the Contractor and the Contractor elected to stop its Work consistent with the procedure set forth in this Section, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up as provided for in the Contract Documents. However, if the Contractor stops its Work and it is determined that the Owner had the right to withhold payment under the terms of the Contract Documents, then the Contractor shall be responsible to the Owner for all costs and damages (including attorneys' fees) arising from such stoppage of Work and the Contractor shall not be entitled to any adjustment in the Contract Sum or the Contract Time. This Section shall not apply: (a) to the extent that the Contractor owes to the Owner any amount pursuant to the provisions of this Contract, or (b) to the extent the Owner is required to expend amounts to purchase additional insurance on behalf of the Contractor to meet the insurance requirements of this Agreement.

§ 9.8 Substantial Completion

§ 9.8.1 The date of Substantial Completion of the Project or a designated portion thereof is the date when construction is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the entire Project (or such portion thereof as Owner earlier elects to occupy or utilize) for the use for which it is intended. Minor items of completion or correction ("Punch List Work") may be performed after Substantial Completion, provided that such items can and shall be performed at such times and in such manner that such Work does not unreasonably interfere with the Owner's occupancy and use of the Project. Substantial Completion shall not be deemed to exist until (a) the Owner receives a Certificate of Occupancy for the Project (or such portion as elected by Owner) if such Certificate of Occupancy is required, and any other permits, approvals, licenses and any other documents from governmental authorities having jurisdiction therefore necessary for the beneficial occupancy of the Project and (b) the Contractor, Construction Manager, Architect and Owner have agreed upon a schedule for final completion and to provide the Owner with all as-built drawings, operating manuals, warranties and other required closeout documents. Warranties called for by the Agreement or by the Drawings and Specifications shall commence on the date of Substantial Completion of the Project or designated portion thereof, or any later date that the parties agree. This date shall be established by a Certificate of Substantial Completion signed by the Owner, Contractor, Architect and Construction Manager.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager in writing on the Contractor's letterhead and the Contractor shall prepare and attach thereto a comprehensive list, to be submitted to the Architect, identifying all non-conforming, defective and incomplete Work. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the requirements of the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Construction Manager or Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion. If the Architect and the Construction Manager are required to perform additional substantial completion inspections because the Work fails to be substantially complete, the amount of compensation paid to the Architect and the Construction Manager by the Owner for additional services shall be deducted from the final payment to the Contractor.

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§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute, a Certificate of Substantial Completion that shall establish the date of Substantial Completion, establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and fix the time within which the Contractor shall finish all Punch List Work, which timeframe shall not exceed 30 days. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

§ 9.8.5.1 In conformance with New York General Municipal Law Section 106-b(1)(a), upon proper execution of Certificate of Substantial Completion of Work, the Contractor shall submit a requisition for payment of the remaining amount of the Contract Sum. Upon certification of payment by the Architect, the Owner will approve and promptly pay the remaining amount of the Contract Sum less two times value of any remaining items to be completed or corrected and less an amount necessary to satisfy any claims, liens or judgments against Contractor which have not been suitably discharged. Such payment shall be made under terms and conditions governing final payment except that the Owner's making of such payment shall not constitute the Owner's waiver of any objection to all or any portion of the Work performed by the Contractor or any claims the Owner may then have against the Contractor.

§ 9.8.5.2 Neither the requisition for payment stipulated in Section 9.8.5.1 nor any portion of retained percentage shall become due until the Contractor submits to the Construction Manager:

.1 an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work for which the Owner or the Owner's property might in any way be responsible, have been paid or otherwise satisfied, the forms of which will be the currently authorized AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims" and G706A "Contractor's Affidavit of Release of Liens";

.2 consent of all sureties, if any, to such payment, the form of which will be the currently authorized AIA Document G707A, "Consent of Surety to Reduction in or Partial Release of Retainage," but which will not be required if the amount withheld under Section 9.8.3.1 exceeds the amount of retainage;

.3 if required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases, and waivers of liens arising out of contract to such extent and in such form as may be designated by the Owner; and

.4 all closeout documents.

§ 9.8.5.3 As the Punch List Work is satisfactorily completed or corrected, the Contractor may submit a requisition for payment of these items. The Contractor shall submit with each such requisition for payment affidavits, consents of surety, and other data as described in Section 9.8.5.2 covering work for which payment is requested. Upon certification of such requisitions by the Architect and Construction Manager, the Owner will approve and promptly pay the requisition less an amount two times that which is necessary to satisfy any claims, liens or judgments against the Contractor which have not been suitably discharged.

§ 9.8.5.4 Where the Project includes heating, air conditioning, electrical, communication, data or other systems which are not put into operation at the time of occupancy, a sum shall be withheld until these systems have operated to the general satisfaction of the Architect. The Contractor shall provide complete start up and commissioning of the systems with a detailed check list as recommended by the equipment or system manufacturer. The retained amount shall approximate five percent (5%) of the cost of the systems as determined by the cost breakdown submitted. The guaranty/warranty period for such systems will not commence until after such Architect approval.

§ 9.8.5.5 The Contractor shall complete the Punch List Work for the Project no later than 30 days after Substantial Completion of the Project. The Contractor shall be fully liable to the Owner for all damages suffered by the Owner as a result of delay in achieving final completion of the Work, including without limitation, additional architectural and construction management fees related to extended services.

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§ 9.8.6 If the Architect or the Construction Manager is required to inspect the Work more than two (2) times prior to certifying the Work as being substantially complete on account of the discovery of one or more items that are not sufficiently complete, the Contractor shall be liable to the Owner for the amount of any costs, additional fees or compensation due from or paid by the Owner to the Architect or the Construction Manager for the additional inspections.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

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

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

§ 9.9.4 The Contractor shall cooperate with the Owner in order to make portions of the Project available as soon as possible.

§ 9.9.4.1 The Project site and buildings, whether work of the Contractor is partially or fully completed or not, are property of the Owner who shall have certain rights and privileges in connection with use of same.

§ 9.9.4.2 Should there be, in the opinion of the Architect or Construction Manager, unwarranted delay on part of any Contractor in completion of incomplete or defective work or other Contract requirements, and the Architect so certifies, the Owner may have full or partial use and occupancy of any or all portions of buildings as required for moving in or installing furniture, fixtures, supplies, or equipment and for general cleaning and maintenance work. In such event, the Contractor whose unfinished work is done subsequent to installation of furniture, fixtures, equipment, etc., shall be responsible for the prevention of any damage to such installation. Such use or occupancy by the Owner shall in no instance constitute acceptance of any of the Work.

§ 9.10 Final Completion and Final Payment

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

§ 9.10.1.1 If the Work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the one-year correction period described in Article 12.2

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shall be set by the Architect at his discretion, but not later than the date of the final Certificate for Payment.

§9.10.1.2 If the Architect and the Construction Manager are required to provide additional services, extend the duration of services to the Owner, or perform additional final inspections because the Work fails to comply with the requirements of the Contract Documents, or the Contractor did not complete the Work in accordance with the construction schedule or Project schedule, the amount of compensation paid to the Architect and the Construction Manager by the Owner for additional services shall be deducted from the final payment due to the Contractor.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) all closeout documents required by the Contract Documents, including, without limitation, as-built drawings, attic stock, maintenance manual, operating instructions and other documents required to be delivered under the Contract in connection with the Work in the form required by the Owner, (2) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (3) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (4) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (5) consent of surety, if any, to final payment, (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (7) all warranties and guarantees required by the Contract Documents, including, without limitation, a 2-year maintenance bond in the penal sum of 100% of Contract Sum including change orders, and the Contractor's letter guaranteeing workmanship for two (2) years. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.2.1 In addition to the submittals required in Section 9.10.2 above, the Contractor shall submit separate final release or waivers of lien for each Subcontractor, material supplier, or others with lien rights against the Project, and shall submit a list of such parties.

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

§ 9.10.4 The making of final payment
(Paragraphs deleted)
by the Owner shall not constitute a waiver of claims, causes of action, damages or complaints by the Owner.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing in accordance with Article 15 and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 At any time a lien is filed against the Project funds, the Owner may demand that the Contractor discharge said lien, through bonding or otherwise, and the Contractor must obtain the discharge of said lien within seven (7) days of such demand at the Contractor's sole cost and expense, and at no cost to the Owner. If any lien or other encumbrance required to be removed at the Contractor's sole cost and expense pursuant to this Section is not discharged of record as aforesaid, the Owner shall have the right to take such action as the Owner shall deem appropriate (which shall include the right to cause such lien or other encumbrance to be canceled and discharged of record), and in such event, all costs and expenses incurred by the Owner in connection therewith (including, without limitation, premiums for any bond

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furnished in connection therewith, and reasonable attorneys' fees,
court costs and disbursements), shall be paid by the Contractor to the Owner on demand or, at the option of the Owner, deducted from any payment then due or thereafter becoming due from the Owner to the Contractor in accordance with the provisions of these General Conditions.

§ 9.10.7 Existing warranties shall not deprive the Owner of any cause of action, right, or remedy otherwise available for breach of any of the provisions of the Contract Documents. The periods referred to above shall not be construed as limitations on the time in which the Owner may pursue any such action, right or remedy.

§ 9.10.8 The Contractor shall achieve final completion of all Work, including, without limitation, correction of punch-list items, preparation and delivery of all manuals, presentation of training and completion of final paper submissions not later than 30 days following the date of Substantial Completion. In the event the Contractor shall fail to achieve final completion of the Work within such a period of time, the Contractor and the Contractor's surety, if any, shall be liable for and shall reimburse the Owner for any and all fees paid to the Architect and Construction Manager and other expenses made necessary by the Contractor's failure. Additional fees and expenses shall be charged by the Owner against any Final Payment due or which may become due to the Contractor, and the Contractor shall promptly pay or refund the Owner the excess, if any, upon the Owner's written request.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager. The Contractor's safety precautions and programs shall include specific steps designed to minimize the risk of contracting or spread of COVID-19, including provision of all appropriate personal protective equipment, social distancing, avoiding stacking of trades, and other reasonable precautions.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take necessary precautions for safety of, and shall provide reasonable protection to prevent damage, injury, infection or exposure to COVID-19, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;
- **.3** the Owner's real and personal property and other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction;
- **.4** construction or operations by the Owner, Separate Contractors, or other Contractors; and
- **.5** the existing buildings and premises in the vicinity of or affected by the Contractor's operations.

§ 10.2.1.6 Safe access to and egress from any building under construction as part of this Contract, or any existing building in which Work is being done under this Contract, shall be maintained and remain unencumbered by the Contractor in accordance with all applicable codes, rules and regulations of authorities having jurisdiction on the Work. The Contractor and its Subcontractors shall cooperate in maintaining this condition. Roadways, paths, walks, exits, service drives and other areas shall remain unobstructed and shall be maintained in a safe and satisfactory condition, for all persons using the building and premises. Materials shall not be stored promiscuously about the site or in the building, but shall be carefully stored in areas which will not interfere with pedestrian traffic or with access to and egress from adjacent properties and use of the building. The Contractor shall provide and maintain such temporary Work as may be required for the protection of its finished Work where liable to injury. The Contractor will be responsible for all of its Work, materials and equipment that may be damaged or stolen during the duration of the Contract and until the Work is accepted by the Owner. The Contractor shall make good any such damage or loss without expense to the Owner. The Contractor shall not permit unnecessary hazards to be created nor permit them to continue if they are discovered. The Contractor's storage and staging areas shall be only in locations assigned or approved by the Owner and Architect and may be required to be relocated by the Contractor as building occupancy or

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use changes during the course of the Work. This relocation will be done by the Contractor at no additional cost to the Owner.

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

§ 10.2.2.1 The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and the Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and the Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract. The Contractor shall indemnify and hold harmless the Owner of and from any and all liability for violation of such laws and regulations and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail or refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fee, in recovering such defense costs from the Contractor.

§ 10.2.2.2 All laborers, workers, and mechanics employed in the performance of the Work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least 10 hours in duration. The Contractor and its Subcontractors shall conduct their operation in accordance with the Contractor's safety program.

§ 10.2.2.3 All safety equipment including hard hats, weather protective gear and PPE required for the Contractor to perform its Work are to be supplied by the Contractor or its Subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, or other agents, and its Subcontractors, employees, superintendents, or other agents are required to wear hard hats and other required or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the Project. No prior warnings will be given by the Owner, Construction Manager or Architect. The Contractor and its Subcontractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the Project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18, and shall not be limited by such damage or loss being insured under property insurance required by the Contract Documents.

§ 10.2.6 The Contractor shall schedule weekly safety meetings and each of its Subcontractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

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§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition. The Contractor shall not load any part of the Work with materials, equipment, shores, bracing, or other items which in any way could cause damage to the Work or to other Work or could endanger persons in or about the Work.

§ 10.2.8 If, during the construction, public or private property is damaged or destroyed as a consequence of its Work, the Contractor shall, at its own expense, restore such property to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or replacing it, or otherwise making good such damage or destruction in an acceptable manner.

§ 10.2.9 The Contractor shall be responsible for all breakage of glass, which has been furnished and installed as part of Contract and existing glass that is broken due to operations under the Contract for Work. No matter by whom or what cause glass was broken, the Contractor shall replace all broken glass before completion and acceptance of the Contractor's Work. The Contractor may claim damages, if applicable.

§ 10.2.10 In addition to all requirements set forth herein, the Contractor and its Subcontractors shall fully comply with the provisions of the federal Occupational Safety and Health Act of 1970, as amended, and with any rules and regulations pursuant to that Act. This requirement shall apply continuously and not be limited to normal working hours.

§ 10.2.11 The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor at its sole expense.

§ 10.2.12 The Contractor shall immediately contact the Construction Manager and, within 24 hours, report, in writing, to the Owner, Architect and Construction Manager, all accidents arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager, and Architect.

§ 10.2.13 The Contractor shall be solely responsible for any conditions that develop during construction and in the event any structure is dislocated, over strained, or damaged so as to affect is usefulness, the Contractor shall be solely responsible. The Contractor shall take whatever steps necessary to strengthen, relocate or rebuild the structure to meet requirements at the sole expense of the Contractor.

§ 10.2.14 The Contractor is responsible for restoration and repair of utilities, private property, buildings, pavement, walkways, roads, etc. damaged by its activities under this Agreement to the satisfaction of the Owner, Construction Manager and Architect.

§ 10.2.15 From the commencement to the final completion of the Work, the Contractor shall keep the Work and the Owner's building(s) free from accumulation of water no matter the source or cause of water infiltration.

§ 10.2.16 During construction, the Contractor shall be responsible for maintaining a watertight structure. This responsibility shall include additions/alterations of existing buildings. The Contractor shall be responsible for temporary roofing, tarps and other protection at roofs, cavity walls, etc. Should the Contractor fail to provide adequate protection causing flooding, damage or other disturbance to the existing building(s), the Contractor shall be responsible for all costs associated with clean up, remediation and repairs. Inasmuch as flooding and water damage have safety implications to the general public, clean up, remediation and repairs may be made by the Owner without prior notice to the Contractor. Administration costs incurred by the Owner, Construction Manager and Architect will also be back charged to the Contractor. The Contractor, by entering into this Contract, agrees to be liable for these costs.

§ 10.2.17 Injury or Damage to Person or Property

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

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§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents and all applicable laws, rules and regulations regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing. The Owner shall arrange for the material to be tested and if the test reveals that the material is a hazardous material or substance which has not been rendered harmless, the Owner shall pay for the test; otherwise, the Contractor shall bear the cost of the test and the Contract Sum shall be reduced by the amount of that cost. The Contractor shall comply with the reasonable instructions of the Owner after the test is conducted. This Section shall not apply in the case of asbestos which is to be removed and disposed of as part of the Work of the Contract.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, but only to the extent of available insurance proceeds, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that the person seeking indemnification: (1) did not bring such material onto the Project site; (2) timely provided notice of the condition and stopped Work in the affected area as required by Section 10.3.1; and (3) has a claim, damage, loss or expense that is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself). The Owner shall have no indemnity obligation to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity or the fault or negligence of a third party for whom the Owner is not responsible.

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

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

§ 10.3.6 If, without negligence or fault on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance (that was not brought to the site by the Contractor or those for whom the Contractor is responsible) solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.3.7 The Contractor shall notify the Owner of any storage, use, or discovery of hazardous material on the Project site which the Contractor knows or reasonably should know could cause bodily injury or death and of any injury or death attributable to any such hazardous material.

§ 10.3.8 The Contractor shall take all reasonable precautions and measures to prevent any contamination by or spread or disturbance of hazardous or potentially hazardous substances or materials stored, used, or discovered on the Project site.

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§ 10.3.9 For the avoidance of any doubt, COVID-19 shall not be considered a Hazardous Material for purposes of this Article 10.3.

§ 10.4 Emergencies

§ 10.4.1 The Contractor shall provide at the site, such equipment and medical facilities as are necessary to supply first-aid service to anyone at the Work.

§ 10.4.2 The Contractor must promptly report in writing to the Construction Manager all emergencies whatsoever arising out of, or in connection with the performance of the Work, whether on, or adjacent to the site, which caused death, personal injury or property damages, giving full details and statements of witnesses. In addition, if death, injury, or damages are caused, the emergency shall be reported immediately to the Construction Manager, Owner, and Architect.

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

§ 10.4.4 All fire and emergency access, including roads, rights-of-way, corridors, doors, and stairs, and all existing fire and smoke detection systems shall be maintained at all times in accordance with fire safety laws. If the Work requires the temporary obstruction of any fire and emergency access or existing fire and smoke detection systems, the Construction Manager shall be notified at least 72 hours in advance.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies licensed to do business in State of New York, having an A.M. Best rating of A- or better, and one to which the Owner has no reasonable objection such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, including private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entitles shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project. As required by the New York State Workers' Compensation Law, all out of state contractors working in New York must provide a Workers' Compensation Insurance Policy that specifically lists New York in Item 3A of the Policy Information page;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations;

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18;

.9 Where the Contract or Subcontract involves asbestos, the insurance required by Section 11.1 shall specifically include the words asbestos abatement work and shall specify any limitations on completed operation time period. If there is a limitation it will be at the Owner's discretion to accept or reject that limitation;

.10 Insurance must 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 Section 12.2.2.2;

.11 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis. The required coverage shall be written on an occurrence basis and shall include the following:

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a. Premises Operations (including X, C and U coverage as applicable).
b. Independent Contractor's Protective.
c. Products and Completed Operations.
d. Contractual, including specified provision for Contractor's obligation under Paragraph 3.18 of the General Conditions.
e. Owned, non-owned and hired motor vehicles.
f. Broad Form Property Damage including Completed Operations.
g. Pollution Legal Liability Insurance.
h. Personal injury liability with Employment Exclusion deleted.

.12 The insurance policies required to be purchased and maintained by the Contractor under this Agreement shall be: (i) written on an occurrence basis, and (ii) shall be primary on a per project basis for the defense and indemnification of any action or claim asserted against the Owner and its Board of Fire Commissioners, employees and volunteers, Construction Manager, Architect, and the Contractor for Work performed under the Agreement regardless of any other collectible insurance or any language in the insurance policies that may be to the contrary. The policies of the Owner, Construction Manager and Architect and their consultants shall be excess and noncontributory.

§ 11.1.2 The insurance required by this Article 11 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of three years after final completion of the Work. All coverages are to be written on an occurrence basis unless approved by the Owner. The Contractor will require all of its Subcontractors to comply with the insurance requirements of this Article 11.

§ 11.1.3 ACORD Form 25S shall be an acceptable form for the Certificates of Insurance when accompanied by AIA Form G715 and all applicable endorsements for the required coverages. The certificate of insurance must describe the specific services provided by the Contractor (e.g., roofing, carpentry, plumbing) that are covered by the liability policies. The Contractor shall also provide the Owner with copies of any endorsements subsequently issued amending coverage or limits. No construction shall be commenced until the Owner has approved the Contractor's certificates of insurance and required endorsements. These certificates and the insurance policies required by Section 11.1 shall contain a provision that the coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner and the Contractor. If any of the foregoing insurance coverages are required to remain in force after final payment, an additional certificate and a copy of the insurance policy evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Review and acknowledgement of the certificates of insurance and endorsements by the Owner or Architect shall not relieve or decrease the liability of the Contractor hereunder.

§ 11.1.3.1 The Contractor's failure to procure or maintain insurance required under this Contract, or provide the required proof of such insurance, shall constitute a material breach of the Contract for which the Owner may, in its sole discretion, stop the Work, withhold payment, or suspend or terminate the Contract. In response to such failure the Owner also may, at its sole discretion, procure or renew such insurance necessary to protect the Owner's interests, pay any premiums in connection therewith and recover (or deduct) all amounts so paid, as well as all other costs and fees incurred as a result of such breach, from the Contractor. It shall not be the basis for an extension of the Contract Time if the operations, services or Work is stopped or delayed due to the Contractor's failure to provide the required insurances or proof of same. The foregoing rights and remedies of the Owner are in addition to the Owner's other rights and remedies. The Contractor shall fully cooperate at all times with any effort by the Owner or Construction Manager to audit compliance with the insurance requirements of Article 11. The Contractor understands and agrees that (a) the Owner's receipt of proper ACORD certificates of insurance and endorsements from the Contractor shall be a condition precedent to the Owner's obligation to make any progress payment under the Agreement, and (b) it shall not be the basis for an extension of the Contract Time if the operations, services or Work is stopped or delayed due to the Contractor's failure to provide proper ACORD certificates of insurance and endorsements.

§ 11.1.4 The Contractor shall cause all liability insurance policies coverage required by the Contract Documents (excluding Workers' Compensation) to include (1) the Owner and its Board of Fire Commissioners, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory for claims caused in whole or in part by the Contractor's negligent acts or omissions during the

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Contractor's operations; and (2) the Owner and its Board of Fire Commissioners, employees and volunteers as additional insureds on a primary and non-contributory for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations. If the terms of policies expire, or the lives of the insurance companies terminate, before the Contract is completed or during the period of completed operations coverage, and the Contractor fails to maintain continuance of such insurance, the Owner is entitled to provide protection for itself, to pay premiums, and to charge the cost to the Contractor.

§ 11.1.5 It is expressly understood and agreed that:

.1 The amount of insurance provided in the insurance coverages required by Article 11 and any other provision of the Contract Documents shall not be construed to be a limitation of the liability on the part of the Contractor or any of its Subcontractors.

.2 Any type of insurance or any increase in limits of liability not described above which the Contractor requires for its own protection or on account of statute or otherwise shall be its own responsibility and at its own expense and shall not be charged back to the Project.

.3 The carrying of insurance described shall in no way be interpreted as relieving the Contractor or any Subcontractor of any responsibility or liability under the Contract.

.4 In the event of a failure of Contractor to furnish and maintain said insurance and to furnish satisfactory evidence thereof, the Owner shall have the right (but not the obligation) to take out and maintain the same for all parties on behalf of the Contractor who agrees to furnish all necessary information thereof and to pay the cost thereof to the Owner immediately upon presentation of an invoice.

.5 Any work performed without having the insurance coverage is at the Contractor's own risk.

.6 Any applicable deductibles and self-insured retentions on the policies required by this Article 11 are the sole responsibility of the Contractor.

§ 11.1.6 Schedule of Insurance

The Contractor and its Subcontractors, at their own expense, shall procure and maintain the following insurance coverages with limits of liability not less than the limits specified, or greater if required by law.

§ 11.1.6.1 Workers' Compensation and Employers' Liability

Workers' compensation and employers' liability insurance coverage complying with the laws of the Project location and elsewhere as may be required and shall include a minimum of:

Workers' Compensation	Statutory
Bodily Injury by Accident:	$1,000,000 Each Accident
Bodily Injury by Disease:	$1,000,000 Each Employee
Bodily Injury by Disease:	$1,000,000 Policy Limit

The workers' compensation and employers' liability policies shall be endorsed to waive the right of subrogation against the Owner and its Board of Fire Commissioners, employees and volunteers.

§ 11.1.6.2 Commercial General Liability

Commercial general liability written on ISO occurrence form providing coverage for Premises and Operations, Products-Completed Operations, Independent Contractors, Personal and Advertising Injury (Employment Exclusion deleted), Blanket Contractual Liability, and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards).

Occurrence Form:	
General Aggregate:	$2,000,000 (per project)
Products/Completed Operations Aggregate:	$2,000,000 (per project)
Each Occurrence:	$1,000,000
Personal and Advertising Injury:	$1,000,000
Property Damage (Aggregate)	$2,000,000 (per project)
Property Damage (Each Occurrence)	$1,000,000
Fire Damage (any one fire):	$300,000
Medical Expense (any one person):	$10,000

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The Contractor shall cause the commercial liability coverage required herein to include Bodily Injury and Property Damage, Damage for Premises/Operations, Products and Completed Operations provided by the General Liability coverage form CG 00 01 in connection with work to be completed by the Contractor and all subcontractors and consultants, with the Owner and its Board of Fire Commissioners, employees and volunteers, Architect and Construction Manager named as additional insureds, on a primary and non-contributory basis, including ongoing and completed operations using ISO form CG 20 10 04/13 or the CG 20 38 04/13 combined with the CG 20 37 04/13. Products and Completed Operations Coverage must be maintained for a period of at least three (3) years after final payment and must provide that the Owner and its Board of Fire Commissioners, employees and volunteers are additional insureds on a primary, non-contributory basis for the same period (using ISO form CG 20 10 04/13 or CG 20 38 04/13 combined with the CG 20 37 04/13). These limits must apply on a per project basis. Coverage must be written on CG 00 01 form or its equivalent. The commercial general liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Fire Commissioners, employees and volunteers.

§ 11.1.6.3 Automobile Liability

Business automobile liability, including liability arising out of any owned, leased, non-owned or hired automobile with per accident limits of liability of not less than $1,000,000. The Contractor shall cause the automobile liability coverage required herein to include the Owner and its Board of Fire Commissioners, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory basis. The automobile liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Fire Commissioners, employees and volunteers.

§ 11.1.6.4 Owners and Contractors Protective Liability Insurance

The Contractor shall procure and maintain at the Contractor's own expense until final completion of the Work covered by the Contract, and any extension thereof, Owners and Contractors Protective Liability Coverage issued in the name of the Owner and covering the liability for damages imposed by law upon the Owner with respect to all operations under the agreement by the Contractor or its Subcontractors, including omissions and supervisory acts of the Owner. Such policy shall be delivered to the Owner no later than fifteen (15) days of awarding the Contract. Unless otherwise specifically required by special specifications, each policy shall be issued with limits not less than $1,000,000 per occurrence and $2,000,000 aggregate.

§ 11.1.6.5 Pollution Legal Liability Insurance

If the Work includes the removal, mitigation or other handling of pollutants or hazardous materials of any type, the Contractor will be required to carry and maintain pollution legal liability insurance coverage with the minimum limits set forth below, in a form acceptable to the Owner and written by an insurance company acceptable to the Owner. Proof of such coverage shall be provided prior to the commencement of the Work. With coverage for the services rendered for the Owner, including, but not limited to removal, replacement enclosure, encapsulation and disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. The limits shall be as follows:

Each Occurrence:	$1,000,000
Products and Completed Operations Aggregate:	$2,000,000
General Aggregate:	$2,000,000 (specific to the project)

These limits shall include products and completed operations. The Contractor's pollution legal liability policy shall also include coverage for non-owned disposal site liability, mold remediation and related expenses. If retroactive date is used, it must pre-date the inception of the Contract. If the Contractor is using motor vehicles to be used for transporting hazardous materials, the Contractor shall provide pollution legal liability broadened coverage (ISO endorsement CA 9948 or equivalent) as well as proof of MCS 90. The coverage shall include a three-year reporting period following substantial completion of the Work. The Contractor shall cause the pollution liability coverage required herein to include the Owner and its Board of Fire Commissioners, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory basis. The pollution legal liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Fire Commissioners, employees and volunteers.

§ 11.1.6.6 Umbrella Liability

Provide follow form excess coverage over the commercial general liability, employers' liability, automobile liability

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and pollution legal liability (if required by contract) policies with limits not less than $5,000,000 each occurrence and $5,000,000 aggregate specific to the Contract. The Contractor shall cause the excess coverage required herein to include the Owner and its Board of Fire Commissioners, employees and volunteers, Construction Manager, Architect, and their consultants as additional insureds on a primary and non-contributory basis. The umbrella liability policy shall be endorsed to waive the right of subrogation against the Owner and its Board of Fire Commissioners, employees and volunteers.

§ 11.2 Owner's Liability Insurance
The Owner shall be responsible for maintaining its usual liability insurance.

(Paragraphs deleted)
§ 11.3 Property Insurance
§ 11.3.1 The Contractor shall purchase and maintain, in a company lawfully authorized to do business in New York, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. Losses up to the deductible amount shall be the responsibility of the Contractor unless caused solely by the Owner.

§ 11.3.1.2 The Contractor's property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss. This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.3 The said insurance policy shall contain a provision that the loss, if any, is to be made adjustable with and payable to the Owner as trustee for the insureds, and a provision that it shall not be changed or cancelled and that it will be automatically renewed upon expiration and continued in force unless the Owner is given thirty (30) days written notice to the contrary.

§ 11.3.1.4 The Contractor shall have the sole responsibility to promptly report any loss to the insurer and to furnish the latter with all necessary details relating to the occurrence of the loss and the amount thereof. The Owner, Construction Manager, Architect, Contractor and all subcontractors of the Contractor waive all rights, each against the others, for damages caused by fire or other perils covered by insurance provided under the terms of this Section, except such rights as they may have to the proceeds of insurance received; provided, however, this waiver shall not apply to any manufacturer, supplier or similar agent under any guarantee or warranty.

§ 11.3.1.5 The Contractor shall not violate or permit to be violated any condition of such policy and shall at all times satisfy the fire safety requirements of the Owner and the insurance company issuing the same.

§ 11.3.1.6 The procurement and maintenance of said policy shall in no way be construed or be deemed to relieve the Contractor from any of the obligations and risks imposed upon it by this Contract or to be a limitation on the nature or extent of such obligations and risks.

§ 11.3.1.7 Not less than thirty days prior to the expiration date or renewal date, the Contractor shall supply the Owner with an updated replacement certificate of insurance and endorsements. The Contractor shall advise the Owner of any letter or notification that cancels, materially changes, or non- renews the policy and Contractor shall require the insurance carrier(s) to copy the Owner on any letter or notification that cancels, materially changes, or non- renews the policy. Before the Contractor shall be entitled to have any progress payment rendered on account of the work which is to be insured pursuant to this Section, it shall furnish to the Owner a certificate in duplicate of the insurance herein

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required. Such insurance must be procured from an insurance carrier approved by the Owner, licensed to do business in the State of New York ("admitted" carrier), and rated at least "A-" by A.M. Best Company.

§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.4
(Paragraphs deleted)
Performance Bond and Payment Bond
(Paragraphs deleted)
§ 11.4.1 The Contractor shall furnish performance and labor and material payment bonds, each in an amount equal to one hundred percent (100%) of the Contract Sum, meeting all statutory requirements of the State of New York, in form and substance satisfactory to the Owner and, without limitation, complying with the following specific requirements:

.1 The prescribed form of the performance and payment bonds shall conform to AIA A312-2010, and other shall be satisfactory to the Owner in the Owner's sole judgment;

.2 The cost of the required bonds shall be included in the Contract Sum;

.3 Bonds shall be executed by a responsible surety licensed in New York State, listed in the latest issue of the U.S. Treasury Circular 570 and having an A.M. Best's rating of no less than A-/IX and shall remain in effect for a period not less than one year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer;

.4 The Contractor shall require the attorney in fact who executes the required bond on behalf of the surety to affix thereof a certified and current copy of his power of attorney indicating the monetary limit of such power; and

.5 Every bond under this Section 11.4.1 must display the surety bond number.

§ 11.4.2 A rider including the following provisions shall be attached to each bond:

"1. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.

2. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the Owner."

§ 11.4.3 All bonds shall be maintained in full force during the duration of the Project and for a period of twelve (12) months after the date of the Contractor's acceptance of final payment as guarantee that the Contractor will make good any faults or defects in the work arising from improper or defective workmanship or materials which may appear during the period.

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§ 11.4.4 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform the surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under any pursuant to any bond issued in connection with the Work.

§ 11.4.5 Notwithstanding any other provisions in any performance or payment bond, it shall not be a condition precedent to termination of a Contract or Contractor that notice be sent to or meeting be arranged or held with the Contractor (principal) and surety, prior to such termination. Any such requirement(s) shall be void and unenforceable and the Owner shall have the right to reject any such bond(s) or ignore such condition. The exclusive method of termination of a Contract or the Contractor is contained in the Contract Documents, and the Contractor and surety expressly agree to be bound thereby.

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

§ 11.4.7 The Contractor shall provide for the continuation of the performance bond as a maintenance bond for two (2) full years after the date of final payment request at the full final Contract Sum.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Owner, through its Architect or Construction Manager, shall have the authority to reject Work performed by the Contractor that does not conform to the requirements of the Drawings, Specifications, or both. The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within two (2) years after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.8.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The obligation set forth hereunder shall survive acceptance by the Owner of the Work or termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

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

§ 12.2.2.3 Upon completion of any Work under or pursuant to this Section 12.2, the two-year period for correction of Work in connection with the Work requiring correction shall be renewed and recommence.

§ 12.2.2.4 The obligations shall cover any repair and replacement to any part of the Work or other property caused by the defective Work.

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

§ 12.2.3.1 If the Contractor fails to commence to correct, repair and make good any defects in its Work within a reasonable time, not to exceed ten (10) days from the date the Contractor received written notice from the Owner per Section 12.2.2.1, the Owner may correct it in accordance with Section 2.5 and the Contractor shall, upon demand, pay to the Owner all amounts which it expends for such corrective work.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner, other Contractors or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents. The Contractor shall also replace or repair to satisfaction of Owner any and all damage done to the building or its contents in consequence of work performed in fulfilling any applicable warranty. This clause is general in nature and will not operate to waive stipulations of other clauses that specify warranty periods in excess of two (2) years.

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

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as determined by the Owner, with the advice of the Construction Manager and Architect. Such adjustment shall be effected whether or not final payment has been made. For this Section to apply, the Owner must accept non-conforming Work in writing specifying the non-conforming Work being accepted. Notwithstanding any acceptance by the Owner, if the Owner discovers non-conforming Work that the Owner has not expressly accepted in writing, the Owner may demand that the Contractor correct such Work as per the provisions of Article 12 hereof.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State of New York, and the parties expressly agree that any claim, dispute, or other controversy of any nature arising out of the Contract or performance of the Work shall be commenced and maintained in New York State Supreme Court, Westchester County.

§ 13.1.2 The Contractor shall at all times observe and comply with all federal, state and local laws and all laws, ordinances and regulations of the Owner, in any manner affecting the Work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the Work, and the Contractor shall defend, indemnify and save harmless the Owner and its Board of Fire Commissioners, officers, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by himself or by his employee or agents. Historical lack of enforcement of any law, local or otherwise, shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with the Agreement unless and until the Contractor has received written consent for the waiver of such compliance from the Owner and the agency responsible for the enforcement of such law.

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§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

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

§ 13.3 Rights and Remedies

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

§ 13.3.2 Neither the acceptance of all or any part of the work covered by the Contract; nor any payment therefore; nor any order or application for payment issued under the Contract or otherwise issued by the Owner, Architect, Construction Manager, or any commissioner, officer, agent or employee of the Owner; nor any permission or direction to continue with the performance of the Contract before or after its specified completion date; nor any performance by the Owner of any of the Contractor's duties or obligations; nor any aid lent to the Contractor by the Owner in its performance of such duties or obligations; nor any delay or omission by the Owner to exercise any right or remedy accruing to it under the terms of the Contract or existing at law or in equity or by statute or otherwise; nor any other thing done or omitted to be done by the Owner, its commissioners, officers, agents or employees; shall be deemed to be a release to the Contractor or its sureties from any obligations, liabilities or undertakings in connection with the Contract or the performance bond or a waiver of any provision of the Contract or of any rights or remedies to which the Owner may be entitled because of any breach thereof, excepting only a written instrument expressly providing for such release or waiver. No cancellation, rescission or annulment hereof, in whole or as to any part of the Contract, because of any breach hereof, shall be deemed a waiver of any money damages to which the Owner may be entitled because of such breach. No waiver by the Owner of any breach of the Contract shall be deemed to be a waiver of any other or any subsequent breach.

§ 13.3.3 The rights stated in these General Conditions and the Contract Documents are cumulative and not in limitation of any rights of the Owner at law or in equity.

§ 13.3.4 The Owner shall not be responsible for damages or for loss of anticipated profits on Work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's Work.

§ 13.3.5 The Owner shall not be liable to the Contractor for punitive damages on account of its termination of the Contractor or any other alleged breach of the Agreement and the Contractor hereby expressly waives its right to claim such damages against the Owner.

§ 13.3.6 The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect or the Construction Manager taken in connection with the Contractor's Work on the Project.

§ 13.3.7 The Contractor agrees that it waives the defense of privity of contract as between itself and each other Contractor. In the event that an act or omission by another prime Contractor or its Subcontractors of any tier causes impact, damage or loss in any form to the Contractor, then the other prime Contractor responsible in whole or in part for such impact, damage or loss agrees it is directly responsible and liable to the Contractor. The Contractor acknowledges and agrees that this waiver of the defense or privity of contract permits and requires it to commence an action or suit directly against the responsible prime Contractor. The Owner, Architect and the Construction Manager shall not be parties to such suit. The Contractor waives and relinquishes any right and claim as against the Owner, to the extent such claim is caused, or contributed to, by a prime Contractor or its Subcontractors of any tier.

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§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Tests, inspections and approvals of portions of the Contractor's Work required by the Drawings or Specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall arrange for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

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

§ 13.4.3 If such procedures for testing, inspection or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense, including the cost of retesting for verification of compliance if necessary until the Architect certifies that the Work in question does comply with the requirements of the Contract Documents, and none of such costs shall be included in computing the Contract Sum.

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

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

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

§ 13.4.7 Any material to be furnished shall be subject to inspections and tests in the shop and field by the Architect. Shop inspection shall not relieve the Contractor of the responsibility to furnish satisfactory materials and the right is reserved to reject any material at any time before final acceptance of the Work, when in the opinion of the Architect the materials and/or workmanship do not conform to the Specification requirements.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the legal rate as required in General Municipal Law Section 106-b.

§ 13.6 Time Limits on Claims

§ 13.6.1 No action or proceeding shall lie or be maintained by the Contractor, nor anyone claiming under or through the Contractor, against the Owner upon any claim arising out of or based on the Agreement or the Contract Documents or by reason of any act or omission or requirements relating to the giving of notices and information, unless such action or proceeding shall be commenced within one (1) year after submission to the Owner of the final Application for Payment. As to a claim based upon money required to be retained for any period after the date of the final Application for Payment, such action must be commenced within six (6) months after such money becomes due and payable under the terms of the Contract. Notwithstanding, if the Contract is terminated by the Owner, such action by the Contractor must be commenced within six (6) months after the date of such termination. The Contractor's

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acceptance of final payment shall constitute a release of all claims against the Owner. This provision shall not relieve the Contractor of the obligation to comply with the provisions of the law relating to notices of claim.

§ 13.6.2 Acts or failures to act occurring during the construction of the Project or following the issuance of the final certificate for payment, which give rise to a cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor, whichever occurs last.

§ 13.7 No Oral Waiver or Constructive Changes

The provisions of the Contract Documents shall not be changed, amended, waived, or otherwise modified in any respect except by a writing signed by the Owner. No person is authorized on behalf of the Owner to orally change, amend, waive, or otherwise modify the terms of the Contract Documents or any of the Contractor's duties or obligations under or arising out of the Contract Documents. Any change, waiver, approval, or consent granted to the Contractor shall be limited to the specific matters stated in the writing signed by the Owner, and shall not relieve the Contractor of any other of the duties and obligations under the Contract Documents. No "constructive" changes shall be allowed.

§ 13.8 Notices Regarding Liens

The Contractor shall provide to the Owner copies of all notices of any type regarding liens received from Subcontractors, Sub-subcontractors, or suppliers to the Contractor.

§ 13.9 Wages Rates

The Contractor shall, and cause its Subcontractors to, comply with prevailing wage rate determinations as issued by the State of New York Department of Labor for the location and duration of this Project. Current wage rates for this Project are included in the Project Manual.

§ 13.10 General Provisions

Any specific requirement in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and is also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 120 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped; or

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or

.3 Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment after 14 days written notice of such failure to make payment provided that such failure is not due to a disputed amount, and except to the extent the Owner is excused from timely making all or part of any payment on a Certificate for Payment as per any other provisions of the Contract Documents.

Notwithstanding the preceding or anything else in the Contract Documents, the Contractor shall not cease or delay the progress of the Work for any reason other than one set forth in Section 9.7, it being agreed that monetary damages shall be an adequate remedy for the Contractor for any breach of this Agreement or the Contract Documents by the Owner.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon 30 days' written notice and opportunity to cure to the Owner, terminate the Contract and recover from the Owner payment for such Work properly performed for which it has not otherwise been compensated, but in no event shall the Owner by liable to the Contractor for any prospective loss, including, but not limited to, termination expenses, loss of anticipated profits, impact damages, unabsorbed overhead, or the like. Notwithstanding the foregoing, any such payments to the Contractor shall be less any setoffs to which the Owner may be entitled as per any other provision of the Contract Documents.

§ 14.1.4 If the Work is stopped for a period of 90 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon 30 additional days' written notice to the Owner, Construction Manager and Architect (during which the Owner shall have the right and opportunity to cure), terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** refuses or fails to supply enough properly skilled workers or proper materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;
- **.2** fails to make payment to Subcontractors or suppliers for materials or labor in accordance with the respective agreements between the Contractor and its Subcontractors or suppliers;
- **.3** disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority, or its health and safety plan;
- **.4** otherwise is guilty of substantial breach of or default under a provision of the Contract Documents;
- **.5** cannot complete the Work within the Contract Time or within the time to which such completion may have been extended; provided, however, that the impossibility of timely completion is, in the Owner's opinion, attributable to conditions within the Contractor's control;
- **.6** breaches any warranty made by the Contractor under or pursuant to the Contract Documents;
- **.7** is or has been unnecessarily or unreasonably or willfully delaying the performance and completion of the Work, or the award of necessary subcontracts, or the placing of necessary material and equipment orders;
- **.8** refuses to proceed with the Work or extra work when and as directed by the Owner, Construction Manager or Architect;
- **.9** fails or neglects to complete the Work within the Contract Time or in accordance with the Project, Milestone or construction schedules;
- **.10** refuses or fails to correct deficient Work performed by it;
- **.11** the Contractor's progress of the Work is such that the Owner reasonably believes that the Contractor shall not be able to achieve Substantial Completion by the Substantial Completion Date and the Contractor has not delivered and implemented a recovery plan required under the Contract or has not recovered the schedule sufficient to meet the respective Contract Time requirements as required by written notice to the Contractor by the Owner;
- **.12** disregards the instructions of the Construction Manager, Architect or Owner (when such instructions are based on the requirements of the Contract Documents); or
- **.13** the Contractor becomes a party to any insolvency proceeding in a capacity as a debtor, and, in the case of any involuntary proceedings only, such proceeding is not stayed or discharged within twenty-five (25) days after the commencement of same.

§ 14.2.2 When any of the above reasons exist, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' written notice, terminate employment of the Contractor at the expiration of such seven (7) day period, and may, subject to any prior rights of the surety:

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.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient utilizing for such purpose such of the Contractor's plant, materials, equipment, tools and supplies remaining on the site, and also such subcontractors as it may deem advisable, or if may call upon the Contractor's surety at its own expense to do so. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work. Such accounting shall be final, binding and conclusive upon the Contractor, its surety, and any person claiming under or through the Contractor, as to the amount thereof

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

§ 14.2.4 In the event that the Owner declared the Contractor in default of the work or any part of the Work, the Contractor, in addition to any other liability to the Owner hereunder or otherwise provided for or allowed by law, shall be liable to the Owner for any costs it incurs for additional architectural, engineering and construction management services necessary, in its opinion, because of the default and the total amount of liquidated damages from the date when the Work should have been completed by the Contractor in accordance with the terms hereof to the date of actual completion of the Work, both of which items shall be considered as costs incurred by the Owner in completing the Work and the amount of which may be charged against and deducted out of such monies as would have been payable to the Contractor or its surety if the work had been completed without a default. If the costs of finishing the Work exceed the unpaid Contract balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.2.4.1 The costs of finishing the Work also include, without limitation, all reasonable attorneys' fees incurred in responding to the default and enforcing the Owner's rights under the Contract Documents, additional title costs, insurance, additional interest because of any delay in completing the Work, and all other direct and consequential damages incurred by the Owner by reason of the termination of the Contractor as stated herein.

§ 14.2.5 If the Owner wrongfully terminates the Contract for cause, the rights, remedies and obligations of the parties will be the same as if the Owner had terminated the Contract for convenience under Section 14.4.

§ 14.2.6 In the event that the Contractor, or the Contractor's surety, challenges the Owner's termination of the Contract for cause, and the Owner prevails in litigation in connection with such challenge, whether initiated by the Owner or by the Contractor or the Contractor's surety, the Owner shall be entitled to its costs, including reasonable attorney's fees, incurred as a result of such litigation, as part of any judgment against the Contractor or the Contractor's surety. Such costs, including reasonable attorney's fees, shall be deemed a cost of finishing the Work.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine. The Owner shall incur no liability by reason of such suspension, delay, or interruption except that the Contractor may request an extension of its time to complete its Work in accordance with Article 8 hereof.

§ 14.3.2 The Contract Time shall be adjusted for increases in time caused by suspension, delay or interruption as described in Section 14.3.1. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the whole or any portion of the Contract for the Owner's convenience and without cause upon not less than seven (7) days' written notice to the Contractor. Notwithstanding any other provision to the contrary in the Contract, the Owner reserves the right at any time and in its absolute discretion to terminate the services of the Contractor or the Work (or a part thereof) by giving written notice to the Contractor. This

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termination for convenience of the Owner provision allows and authorizes the Owner to terminate this Contract at any time and for any reason whatsoever. This right may be exercised by the Owner in its complete discretion. Termination by the Owner under this Section shall be by Notice of Termination delivered to the Contractor specifying the extent of termination and the effective date.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall immediately and in accordance with instructions from the Owner:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders; and

.4 proceed to complete the performance of the Work required under portions of the Contract not terminated, if any.

§ 14.4.3 Upon receipt of written notice of the Owner's exercise of such termination, the Contractor shall, as the Contractor's sole and exclusive remedy, be paid for the Work properly executed in accordance with the Contract Documents prior to the effective date of termination and for items properly fabricated off-site, delivered and stored in accordance with the Owner's instructions or the Contract Documents before such effective date. The Contractor's entitlement to payment for all such work shall be predicated on its performance of such work in accordance with the Contract Documents as certified by the Architect and Construction Manager. The Contractor shall be entitled to no other payment and waives any claim for damages including, but not limited to, lost profits, any prospective loss, underutilization of personnel or equipment, unabsorbed overhead, and any and all items of consequential loss or damage. The Owner shall be entitled to credit against any payment to be made to the Contractor pursuant to this Section 14.4 the following: (1) payments previously made to the Contractor for the terminated portion of the Work; (2) claims which the Owner has against the Contractor under the Contract Documents; and (3) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor, the cost of which is included in the Contract Sum. Notwithstanding the foregoing, in the event of a termination under Section 14.4.1 prior to the issuance of a Notice to Proceed, the Contractor shall not be entitled to any compensation whatsoever.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Neither a Request for Information, nor a Construction Change Directive, nor a Change Order, nor a reservation of rights, nor minutes of a meeting, nor a daily report, nor any log entry, nor an Owner's request for or the Contractor's response to a Change Order proposal, nor notice of a potential or future claim shall constitute a Claim.

§ 15.1.2 Time Limits on Claims

(Paragraph deleted)

§ 15.1.2.1 Claims by the Contractor must be initiated by written notice to the Owner and the Initial Decision Maker. Claims by the Contractor must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the Contractor first recognizes the condition giving rise to the Claim, whichever is earlier.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by the Contractor must be initiated by written notice to the Owner and to the Architect with a copy sent to the Construction Manager within the time limits set forth in Section 15.1.2.1 above. The purpose of the written notice is to give the Owner prompt opportunity: (a) to cancel or revise orders or directions, change plans, mitigate or remedy circumstances giving rise to the Claim or to take other action that may be desirable; (b) to monitor and verify the facts and circumstances as they occur; and (c) to verify any costs and expenses claimed by the Contractor contemporaneously as they are incurred. Written notice is required whether or not the Owner, Construction Manager or Architect is aware of the facts or circumstances that constitute the basis for the Contractor's Claim, and no action or conduct of the Owner, Construction Manager, Architect or any other person will be regarded as a waiver of such notice requirement except only a written statement to such effect signed by the Owner. Failure of the Contractor to give written notice as required by this Section shall be deemed conclusively to be a waiver and release of any Claim,

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and such written notice shall be a condition precedent to the Contractor's right to make any Claim arising out of, under or in connection with the Contract or its performance of the Work.

§ 15.1.3.2 Written notice shall contain a heading stating "Notice of Claim" to clearly identify it as such. Such notice shall set forth in detail the circumstances that form the basis for the Claim and shall include the following: (1) a clear statement of the claim, including background and chronology; (2) documentation in support of the claim; (3) documentation in support of claimed damages; and (4) certification by responsible officer of the Contractor. The responsibility to substantiate Claims shall rest with the Contractor. An additional Claim arising from the same occurrence or condition made after the Initial Claim has been implemented by Change Order shall not be considered.

§ 15.1.3.3 The Contractor agrees that it has and will make no claim for damages against the Owner by reason of any act or omission to act by any other Contractor, Separate Contractor or Subcontractors having contracts for performance of any portion of work of the Project or in connection with the Owner's, Architect's or Construction Manager's acts or omissions to act in connection with such other Contractors, Separate Contractors or Subcontractors.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim by the Contractor, except as otherwise agreed in writing or as provided in Section 9.7, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments of undisputed amounts in accordance with the Contract Documents; provided, however, that the Contractor shall use its best efforts to furnish the Architect and Owner, as expeditiously as possible, with notice of any Claim including, without limitation, those in connection with concealed or unknown conditions, once such Claim is recognized, and shall cooperate with the Architect and the Owner in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

(Paragraph deleted)

§ 15.1.5 Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3. The Contractor agrees that an express condition precedent to the Contractor's entitlement to any increase in the Contract Sum shall be full and complete compliance to the satisfaction of the Owner with the requirements of Article 15. The Contractor acknowledges the no damages for delay provisions set forth in Sections 8.3.2 and 15.1.6.1.4 hereof.

§ 15.1.5.1 The Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time if:

.1 The Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Sum and Contract Times by the submission of a bid or becoming bound under a negotiated contract; or

.2 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 the Contractor prior to Contractor's making such final commitment;

.3 The Contractor failed to give the written notice within the time and as required by Section 15.1.2; or

.4 If the Owner and the Contractor are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Sum or Contract Times, a claim may be made therefore as provided in Article 15. However, the Owner, Construction Manager, and Architect shall not be liable to the Contractor for any claims, costs, losses or damages sustained by the Contractor on or in connection with any other project or anticipated project.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Sections 15.1.2 and 15.1.3 shall be given. The Contractor's Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 15.1.6.1.1 An application for extension of time must set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time

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claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner, Construction Manager or Architect may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim for an increase in the Contract Time.

§ 15.1.6.1.2 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.6.1.3 The Contractor agrees that an express condition precedent to the Contractor's entitlement to any extension of the Contract Time shall be full and complete compliance to the satisfaction of the Owner with the requirements of Articles 8 and 15.

§ 15.1.6.1.4 The Owner shall not be liable to the Contractor or any of its Subcontractor or Suppliers for claims, impact costs, extended general conditions or delay damages of any nature caused by or arising out of delay, disruption, interference, inefficiencies, impedance, hindrance, acceleration, resequencing, schedule impacts, lack of timeliness by the Owner or its Architect or Construction Manager, and lack of coordination or scheduling, cumulative impact of multiple change orders, errors or omissions in the design of the Project, delay and other performance impacts. The sole remedy against the Owner for such delays shall be the allowance of additional time for completion of the Work, the amount of which shall be subject to the Claims procedure set forth herein. Except to the extent, if any, expressly prohibited by law, the Contractor expressly agrees not to make and hereby waives any claim for damages for delay, including, but not limited to, those resulting from increased labor or material costs, extended general conditions, directions given or not given by the Owner, Construction Manager, or Architect, including scheduling and coordination of the Work; the Architect's preparation of drawings and specifications or the Construction Manager's or Architect's review of shop drawings and requests for instructions; errors or omissions in the design of the Project; or, on account of any delay, disruption, interference, impedance, inefficiency, lack of productivity, obstruction or hindrance for any cause whatsoever by the Owner, Construction Manager, Architect or any other Contractor or Separate Contractor on the Project whether or not foreseeable or anticipated. The Contractor agrees that its sole right and remedy therefore shall be an extension of time, if appropriate. It is emphasized that no monetary recovery may be obtained by the Contractor for delay against the Owner, Construction Manager, Architect, other Contractor or Separate Contractor based on any reason and that the Contractor's sole remedy, if appropriate, is additional time.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction. In planning his construction schedule within the agreed Contract Time, it shall be assumed that the Contractor has anticipated the amount of adverse weather conditions normal to the site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered by the Architect.

§ 15.1.7 Waiver of Claims for Consequential Damages. The Contractor waives any and all claims for consequential damages or any kind and nature arising out of or relating to this Contract. This
(Paragraphs deleted)
waiver of consequential damages shall survive termination of the Contract.

§ 15.2 Initial Decision

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

§ 15.2.2 The Initial Decision Maker will review Claims by the Contractor and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with

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supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim by the Contractor or to furnish additional supporting data, such party shall respond, within 10 days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim by the Contractor in whole or in part.

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

§ 15.2.6 Intentionally omitted.

§ 15.2.6.1 Intentionally omitted.

§ 15.2.7 Intentionally omitted.

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

ARTICLE 16 SPECIAL CONDITIONS

§ 16.1 Equal Opportunity

§ 16.1.1 The Contractor shall maintain policies for equal employment opportunity for construction employment. During performance of the Agreement, the Contractor agrees as follows:

§ 16.1.2 The Contractor and its Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. The Contractor shall take affirmative action to ensure that all applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship and on-the-job training.

§ 16.1.3 The Contractor will post and keep posted in conspicuous places, for employees and applicants for employment, notices obtained by the Contractor from the New York State Division of Human Rights as set forth in the General Regulations of that Division at 9 NYCRR 466.1(a), such conspicuous places to be as defined in 9 NYCRR 466.1(b), and such other postings as that Division may require with respect to New York State's laws, codes, rules, and regulations governing discrimination in employment.

§ 16.1.4 The Contractor will state in all solicitations or advertisements for employees placed by, or on behalf, of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color or national origin.

§ 16.1.5 The Contractor will comply with provisions of Sections 290-299 of the Executive Law and with the Civil Rights Law, will furnish all information and reports deemed necessary by the State Commissioner of Human Rights

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under these non-discrimination clauses and such sections of the Executive Law, and will permit access to the Contractor's books, records and accounts by the Owner, the State Commissioner of Human Rights, the Attorney General and the Industrial Commissioner for the purposes of investigation to ascertain compliance with these nondiscrimination clauses and such sections of the Executive Law and Civil Rights Law.

§ 16.1.6 The Contractor will send to each labor union, or representatives of workers, with which it has, or is bound by a collective bargaining or other Agreement or understanding notices obtained from the State Commissioner of Human Rights, advising such Labor Union or representative of the Contractor's Agreement under requirements of this Article. If the Contractor was directed to do so by Owner as part of the Bid, the Contractor shall request such labor union or representative to furnish him with a written statement that such labor union or representative will not discriminate because of race, creed, color or national origin and that such labor union or representative either will affirmatively cooperate within the limits of its legal and contractual authority in the implementation of the policy and provisions of these non-discrimination clauses or that it consents and agrees that recruitment accordance with the purposes and provisions of these non-discrimination clauses. If such labor union or representative fails or refuses to comply with such a request that it furnish such a statement, the Contractor shall promptly notify the Owner and State Commissioner of Human Rights of such failure or refusal.

§ 16.1.7 The Agreement may be forthwith canceled, terminated or suspended in whole, or in part, by Owner upon the basis of a finding made by the State Division of Human Rights, that the Contractor has not complied with these non-discrimination clauses, and the Contractor may be declared ineligible for future Contracts made by, or in behalf of, the State, or Authority or Agency of the State, or Housing Authority or an Urban Renewal Agency, or Contracts requiring the approval of the Commissioner of Housing and Community Renewal, until it has satisfied the State Division of Human Rights, that it has established and is carrying out a program in conformity with the provisions of these non-discrimination clauses. Such findings shall be made by the State Division of Human Rights after conciliation efforts by the Division have failed to achieve compliance with these non-discrimination clauses and after a verified complaint has been filed with the Division, notice thereof has been given to the Contractor, and an opportunity has been afforded by the Contractor to be heard publicly in accordance with the Executive Law. Such sanctions may be imposed and remedies invoked immediately of, or in addition to sanction in remedies otherwise provided by law. If the Agreement is canceled or terminated under provisions of this Article, in addition to other rights of Owner provided in the Agreement upon its breach by the Contractor, the Contractor will hold Owner harmless against any additional expenses or costs incurred by Owner in completing the work or in purchasing the services, materials, equipment or supplies contemplated by Agreement and Owner may withhold payments from the Contractor in an amount sufficient for this purpose and recourse may be had against authority on the Performance Bond if necessary.

§ 16.1.8 The Contractor will include the provisions of this Article in every subcontract or purchase order in such a manner that such provisions will be binding upon each subcontractor or vendor as to operations to be performed within the State of New York. The Contractor will take such action in enforcing such provisions of such subcontractor or purchase order as the State Division of Human Rights or the Owner may direct, including sanctions or remedies for non-compliance. If the Contractor becomes involved in or is threatened with litigation with a subcontractor or a vendor, as a result of such direction by the State Division of Human Rights, the Contractor shall promptly so notify the Owner and the Attorney General, requesting the Attorney General to intervene and protect the interests of the State of New York.

§ 16.2 Waiver of Immunity

(Paragraph deleted)

§ 16.2.1 The Contractor hereby agrees to the provisions of Paragraph 139-a and l39-b of the New York State Finance Law and Section 103-a of the New York General Municipal Law, which require that upon the refusal of a person, when called before a grand jury, head of a State department, temporary State commission or other State agency, or the organized crime task force in the Department of Law, which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation concerning any transaction or contract had with the State, any political subdivision thereof, a public authority or with any public department, agency or official of the State or of any political subdivision thereof or of a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transaction or contract.

§ 16.2.1.1 Such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any

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contracts with New York State or any public department, agency or official thereof for goods, work or services, for a period of five years after such refusal.

(Paragraph deleted)
§ 16.2.1.2 Any and all contracts made with the State of New York, or any public department, agency or official thereof since the effective date of this law, by such person, and by an firm, partnership or corporation of which he is a member, partner, director or officer may be canceled or terminated by the State of New York without incurring any penalty or damages on account of such cancellation or termination, but any moneys owning by the State of New York for goods delivered or work done prior to the cancellation or termination shall be paid.

§ 16.3 Non-Collusive Clause as Required by NYS General Municipal Law Section 103-d
(Paragraph deleted)
§ 16.3.1 Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury: Non-collusive bidding certification.

§ 16.3.2 By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief, the following:

(Paragraph deleted)
§ 16.3.2.1 The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competitions, as to any matter relating to such prices with any other bidder or with any competitor.

§ 16.3.2.2 Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor.

(Paragraph deleted)
§ 16.3.2.3 No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

§ 16.3.3 A bid shall not be considered for award nor shall any award be made where requirements of this Article have not been complied with; provided however, that in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which set forth in detail the reasons therefore. Where requirements of this Article have not been complied with, the bid shall not be considered for award nor shall any award by made unless the head of the purchasing agent of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

(Paragraph deleted)
§ 16.3.4 The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed, or pending, publication of new or revised price list for such items, or (c) has sold the same items to other customers at the same prices being bids, does not constitute a disclosure within the meaning of this Article.

§ 16.3.5 Any bid hereafter made to any political subdivision of the state or any public department, agency official thereof by a corporate bidder for work or services performed or to be performed or good sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have been authorized shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of the corporation.

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(Paragraph deleted)

§ 16.4 Assignment of Public Contracts

As provided in Section 109 of the General Municipal Law, the Contractor is prohibited from assigning, transferring, conveying, subletting or otherwise disposing of the same, or of his right title, or interest therein, or his power to execute such contract or any other person or corporation without the previous consent in writing of the officer, board or agency awarding the contract. If any contractor, to whom any contract is let, granted and awarded, as required by law, by any officer, board or agency in a political subdivision, or of any district therein, shall without the previous written consent specified in subdivision one of this section, assign, transfer, convey, sublet or otherwise dispose of such contract, or his right, title or interest therein, or his power to execute such contract, to any other person or corporation, the officer, board or agency which let, made, granted, or awarded such contract shall revoke and annul such contract, and the political subdivision or district therein, as the case may be, and such officer, board or agency shall be relieved and discharged form any and all liability and obligations growing out of such contract to such contractor, and to the person or corporation to which such contract shall have been assigned, transferred, conveyed, sublet or otherwise disposed of, and such contractor, and his assignees, transferees or sublessees shall forfeit and lose all moneys, theretofore earned under such contract, except so much as may be required to pay his employees. The provisions of this section shall not hinder, prevent, or affect an assignment by any such contractor for the benefit of his creditors made pursuant to the laws of this state.

ARTICLE 17 NEW YORK STATE LABOR LAW REQUIREMENTS

(Paragraph deleted)

§ 17.1 Working Hours

§ 17.1.1 The Contractor specifically agrees as required by the New York State Labor Law ("Labor Law"), Sections 220 and 220-d, as amended, that:

.1 No laborer, worker, or mechanic in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or any part of the work included in the Contract Documents shall be permitted or required to work more than eight hours in any one calendar day or more than five (5) days in any one week, except to the extent permitted in the case of extraordinary emergencies described in the Labor Law.

.2 The wages to be paid to each laborer, worker, or mechanic in the employ of the Contractor, Subcontractor, or other person doing or contracting to do all or any part of the work included in the Contract Documents for a legal day's work shall be not less than the prevailing rate of wages as defined by the Labor Law.

.3 Each laborer, workman or mechanic employed by the Contractor, a Subcontractor, or other person doing or contracting to do all or any part of the work included in the Contract Documents shall be provided the supplements required by Article 8 of the Labor Law.

.4 The minimum hourly rate of wage to be paid shall be not less than that stated in the General Conditions, and shall be as designated by the industrial Commissioner.

.5 The Contractor's and any Subcontractor's or other person's filing of payrolls in a manner prescribed by subdivision 3-a of Section 220 of the Labor Law shall be a condition precedent to the to the Owner's payment of any sums due and owing to the Contractor, Subcontractor or other party for work done on or with respect to the Project.

(Paragraph deleted)

§ 17.2 Wage Rates

§ 17.2.1 The Contractor specifically agrees, as required by the Labor Law, that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

.1 the prevailing wage rates as provided in Labor Law Section 220(3) as amended, or,

.2 the minimum wage rates as provided in Labor Law Section 220-d, as amended.

(Paragraph deleted)

§ 17.2.2 The Contractor shall comply with Prevailing Wage Rates as issued by the State of New York Department of Labor for the location and duration of this Project. Current wage rates for this project are included in the Project Manual as part of the Contract Documents. The Contractor is responsible to regularly review "Prevailing Wage Schedules/Updates" available on the "Prevailing Wage/Public Work" link on State of New York Department of Labor "Business in New York" web page (www.labor.state.ny.gov) to identify and implement any applicable changes to Prevailing Wage Rates during the Project.

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User Notes: (930435121)

§ 17.2.3 The Contractor shall comply with all the requirements of the Labor Law Section 220-a, as amended, regarding mandatory submission of certified payroll records, which shall be included with each application for payment.

(Paragraph deleted)

§ 17.3 Anti-Discrimination

(Paragraphs deleted)

§ 17.3.1 The Contractor specifically agrees, as required by the provisions of Section 220-e of the Labor Law, as amended, that:

.1 In the hiring of employees for the performance of work under the Contract or any subcontract hereunder, no contractor, subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall be reason of race, creed, color, sexual orientation, or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates;

.2 No contractor, subcontractor, nor any person on its behalf, shall in any manner, discriminate or intimidate any employee hired for the performance of work under the contact on account of race, creed, color, sexual orientation, or national origin.

.3 There may be deducted from the amount payable to the Contractor by the Owner under the contract a penalty at fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the contract; and

.4 The Contract may be canceled or terminated by the Owner, and all monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

ARTICLE 18 GENERAL MUNICIPAL LAW REQUIREMENTS OF THE STATE OF NEW YORK

§ 18.1 Payment of Contractors and Subcontractors

§ 18.1.1 The Contractor specifically agrees it is bound by Section 106-b of the New York General Municipal Law.

ARTICLE 19 SPECIFIC CONFORMANCE TO THE LAWS OF THE STATE OF NEW YORK

§ 19.1 Statutory Requirements

§ 19.1.1 The parties agree that each is bound to the provisions of the laws of the State of New York governing bidding and contracting for public improvement projects, including but not limited to applicable provisions of the General Obligations Law, Labor Law, and General Municipal Law. To the extent any provisions in the Contract Documents conflict with any provisions of New York Law, the statutory provisions shall prevail and the conflicting provisions in the Contract Documents shall be deemed to conform to the statutory provisions.

§ 19.1.2 To the extent the laws of the State of New York governing bidding and contracting for public improvement projects mandate inclusion of specific terms in contracts for such improvements, but which are not already included in these General Conditions, such terms shall be deemed and hereby are incorporated into these General Conditions.

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User Notes: (930435121)

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

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

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

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name
and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name
and Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

Sample

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 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 the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

Sample

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- **.1** the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- **.2** additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- **.3** liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction 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 the Owner or its heirs, executors, administrators, successors and assigns.

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

§ 11 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 a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the 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.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

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

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

Sample

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§ 16 Modifications to this bond are as follows:

Sample

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

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AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

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

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

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name
and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name
and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

Sample

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

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

Sample

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

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, 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.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

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

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. 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 Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the 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.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

Sample

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§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

Sample

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

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AIA® Document G732™ – 2019

Application and Certificate for Payment, *Construction Manager as Adviser Edition*

TO OWNER:

PROJECT:

APPLICATION NO:

DISTRIBUTION TO:

OWNER ☐
CONSTRUCTION MANAGER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

FROM CONTRACTOR:

VIA CONSTRUCTION MANAGER:

PERIOD TO:
CONTRACT DATE:
PROJECT NOS: / /

CONTRACT FOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703™, Continuation Sheet, is attached.

1. ORIGINAL CONTRACT SUM..... $
2. NET CHANGES IN THE WORK..... $
3. CONTRACT SUM TO DATE *(Line 1 ± 2)* ..... $
4. TOTAL COMPLETED AND STORED TO DATE *(Column G on G703)* ..... $
5. RETAINAGE:

a. _____ % of Completed Work
(Column D + E on G703) $

b. _____ % of Stored Material
(Column F on G703) $

Total Retainage *(Lines 5a + 5b, or Total in Column I on G703)* ..... $
6. TOTAL EARNED LESS RETAINAGE..... $
(Line 4 minus Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT.....
(Line 6 from prior Certificate)
8. CURRENT PAYMENT DUE..... $
9. BALANCE TO FINISH, INCLUDING RETAINAGE

(Line 3 minus Line 6) $

SUMMARY OF CHANGES IN THE WORK	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$	$
Total approved this month, including Construction Change Directives	$	$
TOTALS	$	$
NET CHANGES IN THE WORK	$	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:
County of:
Subscribed and sworn to before me this day of
Notary Public:
My Commission expires:

CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on evaluations of the Work and the data comprising this application, the Construction Manager and Architect certify to the Owner that to the best of their knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... $
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

CONSTRUCTION MANAGER:

By: _____ Date: _____

ARCHITECT: *(NOTE: If multiple contractors are responsible for performating portions of the Project, the Architect's Certification is not required.)*

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Sample

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AIA® Document G703® – 1992

Continuation Sheet

AIA Document G702®, Application and Certificate for Payment, or G732™, Application and Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
			WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	FROM PREVIOUS APPLICATION *(D + E)*	THIS PERIOD	MATERIALS PRESENTLY STORED *(Not in D or E)*	TOTAL COMPLETED AND STORED TO DATE *(D+E+F)*	% *(G ÷ C)*	BALANCE TO FINISH *(C – G)*	RETAINAGE *(If variable rate)*
	GRAND TOTAL								

Sample

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AIA® Document G704™CMa – 1992

Certificate of Substantial Completion, *Construction Manager-Adviser Edition*

PROJECT: *(Name and address)*

PROJECT NUMBER:

CONTRACT FOR:

CONTRACT DATE:

TO OWNER: *(Name and address)*

TO CONTRACTOR: *(Name and address)*

OWNER ☐
CONSTRUCTION MANAGER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

DATE OF ISSUANCE:

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Construction Manager's and Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion thereof designated above is hereby established as , which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty	Date of Commencement

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

CONSTRUCTION MANAGER	**BY** *(Signature)*	**DATE**
ARCHITECT	**BY** *(Signature)*	**DATE**

The Contractor will complete or correct the Work on the list of items attached hereto within days from the above date of Substantial Completion.

CONTRACTOR	**BY** *(Signature)*	**DATE**

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at *(time)* on *(date)*.

OWNER	**BY** *(Signature)*	**DATE**

The responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows: *(NOTE: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)*

Sample

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AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR:

TO OWNER: *(Name and address)*

CONTRACT DATED:

OWNER ☐

ARCHITECT ☐

CONTRACTOR ☐

SURETY ☐

OTHER ☐

STATE OF:

COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707™, Consent of Surety to Final Payment, may be used for this purpose.

   Indicate attachment: ☐ Yes ☐ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof
3. Contractor's Affidavit of Release of Liens (AIA Document G706A™)

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

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AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR:

TO OWNER: *(Name and address)*

CONTRACT DATED:

OWNER ☐

ARCHITECT ☐

CONTRACTOR ☐

SURETY ☐

OTHER ☐

STATE OF:

COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

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AIA® Document G707™ – 1994

Consent of Surety to Final Payment

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR:

TO OWNER: *(Name and address)*

CONTRACT DATED:

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
SURETY ☐
OTHER ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal)

(Printed name and title)

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

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Sample

SECTION 00 73 43 – WAGE RATE REQUIREMENTS

IN ACCORDANCE WITH ARTICLE 8, SECTION 220 (3-a) OF THE NEW YORK STATE LABOR LAW, THE FOLLOWING LINK REPRESENTS THE MOST CURRENT PREVAILING WAGE RATE SCHEDULES AT THE TIME OF BIDDING, ISSUED BY THE NEW YORK STATE DEPARTMENT OF LABOR SPECIFICALLY REQUESTED FOR THIS PROJECT:

PRC # 2020011326

https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1505637

CONTRACTOR IS TO OBTAIN THE PREVAILING WAGE RATES GENERATED FOR THIS PROJECT AT THE NEW YORK STATE DEPARTMENT OF LABOR WEBSITE.

- ASSEMBLY BILL NUMBER 1839
- NOTICES REGARDING WAGE RATE UPDATES
- WAGE RATE SCHEDULE
- LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED PUBLIC WORK

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions, Form WH-347 Inst.)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

OMB No.: 1215-0149
Expires: 03/31/2006

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐

ADDRESS

PAYROLL NO.

FOR WEEK ENDING

PROJECT AND LOCATION

PROJECT OR CONTRACT NO.

(1) NAME, ADDRESS, AND SOCIAL SECURITY NUMBER OF EMPLOYEE	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE / HOURS WORKED EACH DAY							(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
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We estimate that it will take an average of 56 minutes to complete this collection of information, including time for reviewing instructions searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, ESA, U. S. Department of Labor, Room S3502, 200 Constitution Avenue, N. W., Washington, D. C. 20210.

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination Incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, of if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

* U.S. G.P.O.:1997 519.861

SECTION 00 73 47 - DISPENSATION OF HOURS

Important Information about *Request for Dispensation* (PW30)

When a contractor submits a Request for Dispensation to Work Overtime (PW30), the contractor must:

1) Complete and sign the form

2) Have it signed by a representative of the Department of Jurisdiction (Contracting Agency)

3) Submit the signed form to the NYSDOL Bureau of Public Work for review

Failure to have the Department of Jurisdiction (Contracting Agency) complete and sign the form will delay the Bureau of Public Work review.

NEW YORK STATE OF OPPORTUNITY. Department of Labor

Bureau of Public Work
Harriman State Office Campus
Albany, NY 12240
(518) 457-5589 | (518) 485-1870 (fax)
www.labor.ny.gov

Application for Dispensation for Hours

Applicant must complete **both pages**. A representative of the Department of Jurisdiction (Contracting Agency) **must complete** the certification at bottom. Your application **cannot be processed** without this certification.

Applicant: _____

Name and address: _____

Federal Employer Identification Number: _____ Telephone Number: _____

Prevailing Rate Case / PRC # _____ County:
(found on wage schedule)

Project Description: _____

Description of location (City, town, intersection, street or route, etc.): _____

Nature of Project: (Check one)

☐ 1. NEW BUILDING ☐ 2. ADDITION TO EXISTING STRUCTURE ☐ 3. HEAVY AND HIGHWAY CONSTRUCTION (NEW AND REPAIR) ☐ 4. NEW SEWER OR WATERLINE

☐ 5. OTHER NEW CONSTRUCTION ☐ 6. OTHER RECONSTRUCTION, MAINTENANCE REPAIR OR ALTERATION ☐ 7. DEMOLITION

Reason for requesting dispensation:

Dispensation Required: (Complete statement below) **THIS MUST BE SIGNED**

Application is made for a period beginning _____ (Date) and ending _____ (Date) to permit operations_____ hours per day, _____days per week.

_____ (Date) _____ (Signature of Contractor or Authorized Representative) _____ (Print name and title)

Certification by an officer of the Contracting Agency
THIS MUST BE SIGNED

It is hereby certified that the above described Public Work project is of an important nature and that a delay in carrying it to completion would result in serious disadvantage to the public.

_____ (Department of Jurisdiction) _____ (Authorized signature)

_____ (Street address) _____ (Print name and title) (Date)

_____ (City, state) (Zip code) _____ (Area code and telephone number)

Complete and Return

List the job classifications for which this dispensation is requested and the number of employees in each classification.

Job Classification (occupations)	Number to be Employed

When this application is complete, have an officer of the Contracting Agency complete the certification section and return it to this office. No worker, laborer, or mechanic may be employed in excess of 8 hours in any one day nor 5 days in any one calendar week until you receive a notice of determination.

SECTION 01 10 00 - SUMMARY OF WORK - MULTIPLE PRIME CONTRACTS

GENERAL

1.1 PROJECT INFORMATION

A. Project: Bedford Fire Headquarters
B. Project Location: 550 Old Post Road Bedford, NY
C. Owner: Bedford Village Fire District
D. Architect: Sullivan Architecture, PC
E. Construction Manager: Arris Contracting Company, Inc.
F. The overall scope of work includes: Site Preparation, New Fire department building with associated structural, mechanical, plumbing, electrical, and fire protection work, Site upgrades include asphalt pavement, walks, site utilities, etc.

   The contractor shall provide all labor, materials, equipment and services to furnish deliver and install all materials and related work as shown on the drawings, as required by these specifications and/or as directed by the Architect/Construction Manager.

G. Contracts:
   1. The Project will be constructed under a multiple prime-contracting arrangement.
   2. Prime Contracts are separate contracts between the Owner and separate contractors, representing significant construction activities. Each prime contract is performed concurrently with and closely coordinated with construction activities performed on the Project under prime contracts. Prime contracts for this Project include:
      a. Site Work Contract (SC) - Contract # 1
      b. General Work Contract. (GC or GWC) - Contract # 2
      c. Mechanical Work Contract. (MC, HVAC or HC) - Contract # 3
      d. Electrical Work Contract. (EC) – Contract # 4
      e. Plumbing Work Contract. (PC) – Contract # 5
      f. Fire Protection Work Contract (FPC) – Contract # 6

1.2 DIVISION OF WORK

A. Each contract shall include all labor materials, plans, tools, equipment and supervision which are required for or incidental to the proper completion of the work as indicated on the drawings and described in the following specification sections:

1.3 GENERAL REQUIREMENTS – ALL CONTRACTS
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION
00 01 10 Table of Contents
00 01 15 List of Drawing Sheets

PROCUREMENT REQUIREMENTS
00 11 13 Advertisements for Bids
00 21 13 Instructions to Bidders

00 25 13 Pre-bid Meetings

AVAILABLE INFORMATION
00 31 32 Geotechnical Data

PROCUREMENT FORMS AND SUPPLEMENTS
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract #1) – Site Work Construction
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract #2) – General Work Construction
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract # 3) – Mechanical Work Construction
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract #4) – Electrical Work Construction
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract #5) – Plumbing Work Construction
00 41 16 Bid Form – Stipulated Sum (Multiple-Prime Contract #6) – Fire Protection Work Construction
00 43 13 Bid Security Form - AIA A310-2010 Bid Bond
00 45 03 Insurance Certification Form
00 45 13 Bidder's Qualifications – AIA 305-1986 Contractor's Qualification Statement
00 45 19 Non-Collusive Affidavit
00 45 20 Certification of Compliance with Iran Divestment Act
00 45 21 Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act
00 45 22 Sexual Harassment Prevention Certification Form

CONTRACTING FORMS AND SUPPLEMENTS
00 52 13 Standard Form of Agreement Between Owner and Contractor, CM Edition – AIA 132-2019
00 52 14 General Conditions of the Contract for Construction, Construction Manager as Adviser Edition – AIA 232-2019

PROJECT FORMS
00 61 13 AIA A312-2010 Performance Bond
00 61 14 AIA A312-2010 Payment Bond
00 62 73 AIA G732-2019 Application and Certificate for Payment, CM Edition
00 62 74 AIA G703-1992 Continuation Sheet
00 65 16 AIA G704 CMa-1992 Certificate of Substantial Completion, CM Edition
00 65 19 AIA G706-1994 Contractor's Affidavit of Payment of Debts and Claims
00 65 20 AIA G706A-1994 Contractor's Affidavit of Release of Liens
00 65 21 AIA G707-1994 Consent of Surety to Final Payment

CONDITIONS OF CONTRACT
00 73 43 Wage Rate Requirements
00 73 45 Weekly Certified Payroll Form – WH347
00 73 47 NYS DOL Application for Dispensation for Hours

DIVISION 01 – GENERAL REQUIREMENTS

01 10 00 – SUMMARY OF WORK – MULTIPLE PRIME CONTRACT

01 11 00 – MILESTONE SCHEDULE
01 21 00 – ALLOWANCES
01 22 00 – UNIT PRICES
01 23 00 – ALTERNATES
01 26 00 – CONTRACT MODIFICATION PROCEDURES
01 29 00 – PAYMENT PROCEDURES
01 31 00 – PROJECT MANAGEMENT AND COORDINATION
01 31 19 – PROJECT MEETINGS
01 31 50 – COVID-19 CONTRACTOR GUIDELINES FOR CONSTRUCTION
01 32 16 – CONSTRUCTION PROGRESS SCHEDULE
01 33 00 – SUBMITTAL PROCEDURES (includes submittal coversheet & CAD release)
01 45 00 – QUALITY CONTROL REQUIREMENTS
01 45 29 - TESTING LABORATORY SERVICES
01 45 33 – CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES
01 50 00 – TEMPORARY FACILITIES AND CONTROLS
01 60 00 – PRODUCT REQUIREMENTS
01 70 00 - EXECUTION REQUIREMENTS
01 73 29 – CUTTING & PATCHING
01 74 00 - CLEANING AND WASTE MANAGEMENT
01 77 00 - CLOSEOUT PROCEDURES
01 77 01 – CHECKLIST FOR PROJECT CLOSEOUT
01 78 36 - WARRANTIES

1.4 CONTRACT # 1 – SITEWORK CONTRACTOR

In addition to the General Requirements, Division 1, included in this bid package contractor shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections:

DIVISION 10 - SPECIALTIES

107500 – FLAGPOLE

DIVISION 31 - EARTHWORK

311000 – SITE CLEARING
312000 – EARTH MOVING (SITE/CIVIL)
312319 – DEWATERING
314119 – SELECTIVE DEMOLITION
315000 – EXCAVATION SUPPORT AND PROTECTION
315639 – TEMPORARY TREE AND PLANT PROTECTION
315723 – TEMPORARY STORMWATER POLLUTION CONTROL

DIVISION 32 – EXTERIOR IMPROVEMENTS

323000 – CAST-IN-PLACE CONCRETE
321216 – ASPHALT PAVING
321313 – CONCRETE PAVING
321373 – CONCRETE PAVING JOINT SEALANTS

321723 – PAVEMENT MARKINGS
321726 – TACTILE WARNING SURFACING
323119 - DECORATIVE FENCING AND TIMBER GUIDE RAIL
323223 – SEGMENTAL RETAINING WALLS
329200 – MEADOW SEEDING (UPLAND AND BIORETENTION BASIN MIXES)
329300 – LANDSCAPING

DIVISION 33 – UTILITIES

330500 – COMMON WORK RESULTS FOR UTILITIES
331113 – FACILITY WATER DISTRIBUTION PIPING (SITE/CIVIL)
331313 – FACILITY SANITARY SEWERS (SITE/CIVIL)
331343 – FACILITY SEWAGE PUMPING STATIONS (SITE/CIVIL)
331353 – FACILITY SEPTIC SYSTEM (SITE/CIVIL)
331413 – FACILITY STORM DRAINAGE PIPING (SITE CIVIL)
334200 – STORMWATER CONVEYANCE
334600 – SUBDRAINAGE

Special Notes: Contract # 1 – Sitework Contract.

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

2. Sitework Contractor is responsible for all existing subgrade cuts & import as required to achieve specified elevations. Any surplus materials, clearing debris, tree pruning debris, etc. are required to be removed from site & legally disposed.

3. Sitework contractor will coordinate wet taps (Domestic & Fire) with Bedford Town Water Department. Water taps will be done by the Town contractor, Sitework Contractor # 1 must include all permits and the wet tap cost in their base bid as follows 2” tap $ 1200.00, 8” Tap $ 2860.00.

4. Sitework Contract # 1 is responsible for all work associated with bringing water line to within 5’ of building. This includes road opening permit, wet tap, valves, hydrants, disinfection, etc. The Plumbing Contract # 5 will pick it up from 5’ outside the building into the building

5. Site work Contractor is responsible to supply and install all exterior bollards indicated on the drawings
6. All stormwater protection, silt fence, erosion control, and SWPPP maintenance/compliance etc. by Sitework Contractor
7. The Sitework Contractor is responsible for bringing the site roof drain piping up to the building and turn 90 degrees up to finish elevation. The GWC will install his downspout boot and take from there up to the roof.
8. The GC has the building earthwork and to 5’ outside with exception of topsoil, seeding and plantings near the building which are solely the Sitework Contractor.

9. All staging area work shown on staging plan (access roads, laydown area, parking areas, site fence enclosure, etc.) is by Sitework Contractor. Remove and restore all temporary staging surfaces at conclusion of the project.
10. As built drawings showing underground drain lines/basins, water lines, electrical conduits/boxes will be completed by NYS licensed surveyor at the conclusion of the project. (Turn over 3 hardcopies and digital copy to owner)
11. Sitework contractor to include removal and proper disposal offsite of existing items as identified in the Geotechnical report and indicated on Drawing 1/21. (old foundation, stone walls, well abandon, etc.)
12. No import recycled materials will be allowed.

CONTRACT # 2 – GENERAL WORK CONTRACT (GWC or GC)

In addition to the General Requirements, Division 1, included in this bid package contractor shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections :

DIVISION 3 - CONCRETE

033000 – CAST IN PLACE CONCRETE
033600 – POLISHED CONCRETE
034100 – PRECAST STRUCTURAL CONCRETE
035300 – CONCRETE TOPPING

DIVISION 4 - MASONRY

042000 – UNIT MASONRY
047200 – CAST STONE

DIVISION 5 - METALS

051200 – STRUCTURAL STEEL FRAMING
052200 - HAMBRO MD 200
053100 – STEEL DECKING
054000 – COLD-FORMED METAL FRAMING
055000 – METAL FABRICATIONS

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

061053 – MISCELLANEOUS ROUGH CARPENTRY
062013 – EXTERIOR FINISH CARPENTRY
062023 – INTERIOR FINISH CARPENTRY
064020 – INTERIOR ARCHITECTURAL WOODWORK
066023 – EXTERIOR FIBERGLASS FABRICATIONS
066116 – SOLID SURFACE MATERIAL FABRICATIONS

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

071700 – BENTONITE WATERPROOFING
072100 – THERMAL INSULATION
073113 – ASPHALT SHINGLES
074113 – METAL ROOF PANELS
074600 – SIDING AND TRIM
075323 – ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING
076200 – SHEET METAL FLASHING AND TRIM
078413 – PENETRATION FIRESTOPPING
078446 – FIRE-RESISTIVE JOINT SYSTEMS
079200 – JOINT SEALANTS

DIVISION 8 - OPENINGS

081113 – HOLLOW METAL DOORS AND FRAMES
081433 – STILE AND RAIL WOOD DOORS
081436 – ALUMINUM-CLAD STILE AND RAIL WOOD DOORS
082250 – POLYESTER FACED DOORS AND FRAMES
083113 – ACCESS DOORS AND FRAMES
083613 – SECTIONAL OVERHEAD DOORS
085413 – FIBERGLASS WINDOWS
087100 – DOOR HARDWARE and Door Hardware Sets
088000 – GLAZING
089000 – LOUVERS AND VENTS (Non-HVAC related louvers, door louvers)

DIVISION 9 - FINISHES

092116.23 – GYPSUM BOARD SHAFT WALL ASSEMBLIES
092216 – NON-STRUCTURAL METAL FRAMING
092900 – GYPSUM BOARD
093100 – CERAMIC TILING
095113 – ACOUSTICAL PANEL CEILINGS
096500 – RESILIENT FLOORING AND ACCESSORIES
096623 – RESINOUS MATRIX TERRAZZO FLOORING
096723 – RESINOUS FLOORING
096813 – TILE CARPETING
097750 – FRP COATED PANELS
099100 - PAINTING

DIVISION 10 - SPECIALTIES

101400 – SIGNAGE
102113 – TOILET PARTITIONS
102800 – TOILET, BATH, AND LAUNDRY ACCESSORIES
105113 – METAL LOCKERS
105200 – FIRE PROTECTION SPECIALTIES
105213 – AUTOMATED EXTERNAL DEFRIBRILLATOR (AED) SPECIALTIES

DIVISION 11 – EQUIPMENT – not used

DIVISION 12 - FURNISHINGS

123219 - MANUFACTURED METAL CASEWORK
123616 – STAINLESS STEEL COUNTERTOPS
124813 – ENTRANCE FLOOR MATS AND FRAMES

DIVISION 13 – SPECIAL CONSTRUCTION – not used

DIVISION 14 – CONVEYING EQUIPMENT

142100 – ELECTRIC TRACTION ELEVATORS
144200 – WHEELCHAIR LIFTS

DIVISION 31 - EARTHWORK

312319 – DEWATERING
315000 – EXCAVATION SUPPORT AND PROTECTION

DIVISION 33 – UTILITIES

331413 – FACILITY STORM DRAINAGE PIPING (DOWNSPOUT BOOTS)

Special Notes: Contract # 2 – General Work Contractor:

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
2. General Work Contractor is responsible to bring building footprint (and 5’ outside) up to the correct elevation utilizing structural fill. (no recycled import materials permitted). The work to 5’ outside includes all building connected concrete pads, 12” x12” gravel at perimeter, downspout boots, etc. (not included are topsoil, grass and plantings which are by SC)
3. General Work Contractor will install sleeves in foundation walls for penetrations by other prime contractors. MEP contractors to provide GWC with written sketch showing exact height/location(s) with distance from column line and depth below finished slab, within sufficient time for GWC to install. (If information is not provided by MEP, then core drilling is the responsibility of the affected contractor).
4. General Work Contractor is specifically reminded that the majority of the concrete slab placement, will be over the MC radiant heating lines (see radiant flooring slab detail on drawing M3.1) GWC will coordinate with MC during concrete slab pour process to insure proper installation around radiant heat piping.
5. All concrete slabs are to receive Vaporlock 20/20 additive (or equal) to enable floor finishes to be installed without slab moisture issues.
6. General Work Contractor will provide necessary cut-outs and support steel at precast plank /deck penetrations for locations / sizes coordinated with MEP

Contractors. (If information is not provided by MEP, then any costs for cutting the openings afterward is the responsibility of the affected contractor)

7. Access doors for MEP trades furnished by trade requiring access; installation by Contract # 2 – General Work Contractor. All other access doors & scissor attic stair door provided and installed by Contract #2 – General Work Contractor.

8. General Work Contractor will coordinate MEP opening sizes and locations (HVAC units, louvers, vents, etc.) with MEP trades. Lintels for these opening provided and installed by Contract #2 – General Work Contractor.

9. General Work Contractor and subcontractors are not to use plumbing fixtures or drains to wash out mortar pans, grout, adhesives, tools, etc.

10. Downspout boots shown on sitework drawing are Contract # 2 – General Work Contractor. GWC will connect to the Sitework Contractors roof drain piping at the building.

11. Fire Alarm magnetic holders furnished and wired by Electrical contractor, Installed on door by Contract # 2 – General Work Contractor.

12. In addition to daily general housekeeping, the General Work Contractor (Contract #1) shall provide a weekly broom sweep and damp mop of all areas for the entire duration of the project.

13. All new roof curbs and pipe curbs to be supplied, assembled and placed on roof by MC. General Work Contractor will install wood blocking, install curb, provide structural steel supports, cut opening, flash in curb and provide temporary watertight/plywood secure of opening until rooftop HVAC units are set.

14. General Work Contractor is notified that phasing will require multiple mobilizations and multiple crews of various subcontractors.

15. General Work Contractor will install floor protections (utilizing heavy duty “Ram-Board” with taped joints, or equivalent) to protect new floor surfaces from damage until final cleaning and acceptance by owner.

16. General Work Contractor is responsible to supply and install all interior bollards.

17. Contractor is specifically reminded of their responsibilities for clean up as per Section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, within 4 hours of being notified the owner will perform the work with others and deduct the cost from the contractor

1.5 CONTRACT #3 – MECHANICAL WORK CONTRACT (MC)
In addition to the General Requirements, Division 1, included in this bid package contractor shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections:

DIVISION 3 - CONCRETE

033000 – CAST IN PLACE CONCRETE (for HVAC housekeeping pads)

DIVISION 5 - METALS

055000 – METAL FABRICATIONS (for any HVAC related supports)

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

061053 – MISCELLANEOUS ROUGH CARPENTRY (for any HVAC related blocking)

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

078413 – PENETRATION FIRESTOPPING
078446 – FIRE-RESISTIVE JOINT SYSTEMS
079200 – JOINT SEALANTS

DIVISION 8 – OPENINGS

083113 – ACCESS DOORS AND FRAMES
089000 – LOUVERS AND VENTS (ALL HVAC Related Louvers / Vents)

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

230500 – COMMON WORK RESULTS FOR HVAC
230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230517 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230519 – METERS AND GAGES FOR HVAC PIPING
230523.11 – VALVES FOR HVAC PIPING
230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230553 – IDENTIFCATION FOR HVAC PIPING EQUIPMENT
230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713 – HVAC DUCTWORK INSULATION
230719 – HVAC PIPING INSULATION
230923.16 – GAS INSTRUMENTS
232113 – HYDRONIC PIPING
232116 – HYDRONIC PIPING SPECIALTIES
232123 – HYDRONIC PUMPS
232300 – REFRIGERANT PIPING
232913 – VARIABLE FREQUENCY DRIVES
233113 – METAL DUCTS
233300 – AIR DUCT ACCESSORIES
233423 – HVAC POWER VENTILATOR

235123 – LISTED SPECIAL GAS VENTS
235216 – CONDENSING BOILERS
235533.16 – GAS-FIRED UNIT HEATERS
238129 – VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS
238239.13 – CABINET UNIT HEATERS
238316 – RADIANT-HEATING HYDRONIC PIPING
238416 – VEHICLE EXHAUST SYSTEM

DIVISION 26 – ELECTRICAL

260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (for HVAC control wiring)

Special Notes: Contract # 3 – Mechanical (MC) Work Contractor:

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

2. Access doors are furnished by Mechanical Contract # 3 and installed by GWC Contract #2.

3. All HVAC Louvers/vents are supplied and installed by Mechanical Contract # 3 (see drawing A2.5). MC will coordinate opening sizes with GWC (Openings /Lintels by GWC).

4. Mechanical contractor will coordinate any precast plank/deck penetration locations and sizes with the General Work Contractor. All hangers for mechanical items attached to precast plank will be installed with method approved by the precast plank manufacturer.

5. Any wood blocking by Mechanical items by MC Contract # 3. (excluding roof curb blocking by GWC).

6. Radiant floor heating system is by Mechanical Contract # 3. During General Contractors concrete slab placement, the MC will have radiant lines filled with compressed air, prior and will have manpower present to monitor GWC concrete slab pour process to insure proper installation around radiant heat piping.

7. All new roof curbs and pipe curbs to be supplied, assembled and placed on roof by Mechanical Contractor. GWC will install wood blocking, install curb, provide structural steel supports, cut opening, flash in curb and provide temporary watertight/plywood secure of opening until rooftop HVAC units are set.

8. All Concrete Pads for HVAC equipment are by Mechanical Contract # 3.

9. VFD's, disconnects, starters, etc. supplied by Mechanical Contract will be installed by EC, unless noted otherwise.

10. All HVAC control wiring is provided and installed by Mechanical Contract # 3. (Power wiring by EC)

11. Mechanical Contract # 3 is responsible for making their own through wall and through floor duct/piping penetrations and associated patching/fire-stopping.

12. Fire Alarm Duct detectors supplied and wired by EC (Mechanical Contractor installs the duct detector)

13. The Owner is providing three Air-Vac units in the apparatus bay area which are shown on drawing M2.1. MC will provide hangers and installation labor to hang these 3 units tight to ceiling where indicated.

14. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM within 4 hours of being notified the owner will perform the work with others and deduct the cost from the contractor.

1.6 CONTRACT #4 – ELECTRICAL WORK CONTRACT (EC)

In addition to the General Requirements, Division 1, included in this bid package contractor shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

061053 – MISCELLANEOUS ROUGH CARPENTRY (for EC related blocking and plywood backboards)

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

078413 – PENETRATION FIRESTOPPING
078446 – FIRE-RESISTIVE JOINT SYSTEMS

DIVISION 8 - OPENINGS

083113 – ACCESS DOORS AND FRAMES

DIVISION 26 – ELECTRICAL

260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

260544 – SLEEVES & SLEEVE SEALS FOR ELECTRICAL RACEWAYS & CABLING
260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923 – LIGHTING CONTROL DEVICES
260943.23 – RELAY-BASED LIGHTING CONTROLS
262416 – PANELBOARDS
262713 – ELECTRICTY METERING
262726 – WIRING DEVICES
262813 – FUSES
262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
263213.14 – DIESEL ENGINE GENERATORS
263600 – TRANSFER SWITCHES
264313 – SURGE PROTECTION LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
265119 – LED INTERIOR LIGHTING
265219 – EMERGENCY AND EXIT LIGHTING
265619 – EXTERIOR LIGHTING

DIVISION 27 – COMMUNICATIONS

271323 – COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING
271513 – COMMUNICATIONS COPPER HORIZONTAL CABLING

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

280513 – CONDUCTORS AND CABLES ELECTRONIC SAFETY AND SECURITY
284621.1 - ADDRESSABLE FIRE-ALARM SYSTEMS

DIVISION 31 - EARTHWORK

312000 – EARTH MOVING (FOR SITE ELECTRIC SERVICES, PADS & LIGHTING)
312319 – DEWATERING (FOR ELECTRICAL RELATED EXCAVATIONS)
315000 – EXCAVATION SUPPORT AND PROTECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

323000 – CAST-IN-PLACE CONCRETE (SITE LIGHTING BASES, TRANSFORMER PAD, GENERATOR PAD,ETC.)

DIVISION 33 – UTILITIES

330500 – COMMON WORK RESULTS FOR UTILITIES

Special Notes: Contract # 4 – Electrical Work Contract (EC)

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

2. Access doors are furnished by Electrical Contract # 4 and installed by GWC Contract # 2.

3. VFD's, disconnects, motor starters, etc. which are supplied by MC will be installed by Electrical Contractor, unless noted otherwise.

4. All Excavation / Backfill for sitework and building electrical items (service conduits, transformer pad, U/G conduits, pull boxes, site lighting pole bases, etc.) is by Electrical Contract # 4. This includes proper backfill , compaction and restoration to original condition for any impacted surfaces.

5. Electrical Contractor to provide GWC with any foundation sleeves and written sketch showing exact height/location(s) with distance from column line and depth below finished slab, within sufficient time for GWC to install. (If information is not provided by EC in time, then core drilling is the responsibility of the EC)

6. Fire Alarm magnetic holders furnished and wired by Electrical contract # 4, Installed on door by GWC Contract #2.

7. All systems wiring is by Electric Contract # 4 – including Fire Alarm, Door Access, Security Camera, Speakers, Data, etc.

8. Any wood blocking or panel backboards for electrical items by EC contract # 4.

9. All Concrete for electrical items is by Electrical Contract # 4. (Site Lighting bases, Transformer Pad, Generator pad, etc.)

10. Power wiring for any condensate pumps is by Electrical Contractor. See MEP drawings for locations.

11. For Plumbers flushometers: The Electrical Contractor will install the PC provided transformer above the ceiling and install the wire to in-wall box. The Electrical Contractor then makes the wire connection from the electrical in -wall box to the flushometer.

12. Electrical Contractor will coordinate any precast plank/deck penetration locations and sizes with the General Work Contractor. All hangers for Electrical items attached to precast plank will be installed with method approved by the precast plank manufacturer.

13. Any Solenoid valves supplied & installed by PC – wiring and connections by Electrical Contract.

14. Electrical Contract # 4 to provide and wire Fire Alarm duct detectors (MC install the duct detector)

15. Electrical Contractor is specifically notified construction is phased which necessitates that utilities & services will need to be temporarily connected and maintained as necessary to ensure that all occupied areas have the required services.

16. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM within 4 hours of being notified the owner will perform the work with others and deduct the cost from the contractor.

1.7 CONTRACT # 5 – PLUMBING CONTRACTOR

In addition to the General Requirements, Division 1, included in this bid package contractor shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections:

DIVISION 3 - CONCRETE

033000 – CAST IN PLACE CONCRETE (FOR PLUMBING HWH EQUIPMENT PAD, ETC.)

DIVISION 5 - METALS

055000 – METAL FABRICATIONS

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

061053 – MISCELLANEOUS ROUGH CARPENTRY (FOR PLUMBING RELATED BLOCKING)

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

078413 – PENETRATION FIRESTOPPING
078446 – FIRE-RESISTIVE JOINT SYSTEMS
079200 – JOINT SEALANTS

DIVISION 8 - OPENINGS

083113 – ACCESS DOORS AND FRAMES

DIVISION 22 – PLUMBING

220500 – COMMON WORK RESULTS FOR PLUMBING
220517 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
220518 – ESCUTCHEONS FOR PLUMBING PIPING
220519 – METERS AND GAUGES FOR PLUMBING PIPING
220523 – GENERAL-DUTY VALVES FOR PLUMBING PIPING
220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220719 – PLUMBING PIPING INSULATION AND JACKETS
221114 – NATURAL AND PROPANE-GAS PIPING

221116 – DOMESTIC WATER PIPING
221119 – DOMESTIC WATER PIPING SPECIALTIES
221123.21 – DOMESTIC WATER RECIRCULATION PUMPS
221316 – SANITARY WASTE AND VENT PIPING
221319 – SANITARY WASTE PIPING SPECIALTIES
221319.13 – SANITARY DRAINS
221429 – SUMP PUMPS
221513 – GENERAL SERVICE COMPRESSED AIR PIPING
223400 – FUEL FIRE DOMESTIC HOT WATER HEATERS
224213.13 – COMMERCIAL WATER CLOSETS
224213.16 – COMMERCIAL URINALS
224216.03 – COMMERCIAL LAVATORIES AND FAUCETS
224216.16 – COMMERCIAL SINKS
224223 – COMMERCIAL SHOWERS
224500 – EMERGENCY PLUMBING FIXTURES
224716 – WATER COOLERS AND BOTTLE FILLERS

DIVISION 31 - EARTHWORK

312000 – EARTH MOVING (TRENCHING/ BACKFILL/COMPACTION FOR SUBSLAB PIPE WITHIN BUILDING TO 5' OUTSIDE)
312319 – DEWATERING (FOR PLUMBER EXCAVATED TRENCHES)

Special Notes: Contract # 5 – Plumbing Contract.

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

2. Access doors for plumbing items provided by Plumbing Contract # 5; installation by Contract # 2 – General Work Contractor.

3. ALL excavation / backfill, (structural fill under slab areas), and compaction for plumbing piping by is by Plumbing Contract # 5.

4. Plumbing Contractor to provide GWC with any foundation sleeves and written sketch showing exact height/location(s) with distance from column line and depth below finished slab, within sufficient time for GC to install. (If information is not provided by PC in time, then core drilling is the responsibility of the PC)

5. All concrete pads for plumbing equipment /items are by Plumbing Contract # 5.

6. Plumbing Contractor takes the fire service water line from 5' outside the building, brings it into the building and supplies/installs the sprinkler backflow preventor assembly as indicated on drawing FP5.1 and P4.2 (Tamper switches for OS & Y valves provided by Fire Protection Contractor). All Fire Protection work beyond the BF preventor is by Fire Protection Contract # 6.

7. Plumbing Contractor provides and installs Flushometers and drills holes. PC supplies the associated transformer to the EC. All wiring of Flushometers is by EC.

8. Plumbing Contractor will coordinate any precast plank/deck penetration locations and sizes with the General Work Contractor. All hangers for Plumbing items attached to precast plank will be installed with method approved by the precast plank manufacturer.

9. Hose Reels, water piping and compressed air piping by Plumbing Contractor.

10. Once GWC completes flat roof areas, Plumbing Contractor will provide temporary piping/leaders from their roof drains to 100' away from the building to handle roof runoff until the permanent storm draining piping is installed.

11. Any Solenoid valves supplied & installed by Plumbing Contractor (wiring and connections by EC)

12. Plumbing Contractor is responsible for making their own through wall and through floor piping penetrations and associated patching/fire-stopping.

13. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, within 4 hours of being notified the owner will perform the work with others and deduct the cost from the contractor.

1.8 CONTRACT #6 – FIRE PROTECTION CONTRACTOR

In addition to the General Requirements, Division 1, included in this Fire Protection bid package shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

061053 – MISCELLANEOUS ROUGH CARPENTRY (for any fire protection related blocking)

DIVISION 8 - OPENINGS

083113 – ACCESS DOORS AND FRAMES

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

078413 – PENETRATION FIRESTOPPING
078446 – FIRE-RESISTIVE JOINT SYSTEMS
079200 – JOINT SEALANTS

DIVISION 21 – FIRE SUPPRESSION

210517 – SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING
210518 – ESCUTCEONS FOR FIRE-SUPPRESSION PIPING
210523 –GENERAL-DUTY VALVES WATER-BASED FIRE-SUPPRESSION PIPING
210529 - HANGERS & SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
210553 – IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT
211119 – FIRE-DEPARTMENT CONNECTIONS
211313 – WET-PIPE SPRINKLER SYSTEMS

Special Notes: Contract #6 – Fire Protection Contract.

1. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

2. Access doors for Fire Protection items by FPC Contract # 6; installation by Contract # 2– General Work Contractor.

3. Plumbing Contractor takes the fire service from 5' outside the building, brings it into the building and supplies/installs the sprinkler backflow preventor assembly as indicated on drawing FP5.1 & P4.2 (Tamper switches for OS & Y valves provided by Fire Protection Contractor). All Fire Protection work beyond the BF preventor is the Fire Protection Contract # 6.

4. Fire Protection Contract # 6 is responsible for making their own through wall and through floor piping penetrations and associated patching/fire-stopping.

5. Fire Protection Contractor will coordinate any precast plank/deck penetration locations and sizes with the General Work Contractor. All hangers for Fire Protection items attached to precast plank will be installed with method approved by the precast plank manufacturer.

6. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, within 4 hours of being notified the owner will perform the work with others and deduct the cost from the contractor.

1.9 PRIME CONTRACTOR'S USE OF PREMISES

Use of the Site: Limit use of the premises to work in areas indicated. Confine operations areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the work is indicated.

Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

Existing building spaces may not be used for storage unless approved by the CM and Owner.

Time Restrictions: Working hours M-F 7:00AM – 4:30PM.

Owner's representative(s) will cover the project for the standard Monday-Friday shift. If contractor requests additional hours to make up schedule time or weekends, he will need to reimburse owner for any additional coverage or costs (e.g. – Architect, Construction Manager, etc.) at their contractual rate.

General: Limitations on site usage as well as specific requirements that impact utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, the Contractor shall administer allocation of available space equitably among the separate sub contactors and other entities needing access and space, so as to produce the best overall efficiency in performance of the total work of the project. The Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractors.

Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off-site.

The Contractor(s) and any entity for which the Contractor is responsible shall not erect any sign of the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

Contractor shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of: Any areas and buildings adjacent to the site of the work or; The Building in the event of partial occupancy.

Maintain the building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building during the construction period.

Each Prime contractor is responsible for maintaining a safe jobsite. This include actively reviewing their work areas to ensure that they are in compliance with all required OHSA regulations. It is a contract requirement that each contractor conducts weekly tool-box safety meetings to ensure that their employees are properly educated and utilizing safe work practices. (Copies of these weekly meetings and a list of the attendees will be forwarded to the CM site superintendent on a weekly basis). Contractors will comply with all requirements outlined in the General Conditions including providing their employees with PPE (personal protective equipment), such as masks, hand sanitizer for COVID, hard hats, proper work boots, safety harness, safety glasses, etc.

Smoking, drinking of alcoholic beverages or open fires will not be permitted on the project site.

Utility Outages and Shutdown:

a. Limit disruption of utility services to hours the building is unoccupied, weekends or holidays at no additional cost.
b. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days' notice to Bedford Fire Department and authorities having jurisdiction.
c. Prevent accidental disruption of utility services to other facilities.
d. All costs for manning of temporary shutdowns and utility crossovers, including 24-hour fire watch if necessary, is included in the contractor's bid regardless of weekend, holiday, etc.

1.10 OCCUPANCY REQUIREMENTS

Partial owner Occupancy: The Owner reserves the right to occupy the place and install equipment in completed areas of the work prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work, such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

The Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner occupancy.

Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions of the building.

Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building.

1.11 Not used

1.12 DEFINITIONS

Definitions as applied to “Contractors” involved with the work of this Project:

“The Contractor” or “Contractor” meaning that Respective Prime Contractor normally responsible for that work referenced;

“Respective Prime Contractor” meaning either the – General Contractor, Plumbing, HVAC , Electrical , Sitework, Fire Protection Contractors normally responsible for the referenced work;

“Trade Contractor” meaning that Respective Prime Contractor as above; and such other terms relating to Contractors to be taken in context with respect to referenced work.

Further, wherein said Division 0 and 1 and respective Sections therein, any reference is made to “General Contractor”, same shall be construed to mean “Contractor for the General Construction, or General Work Contractor”.

The Owner cannot guarantee the correctness of the existing conditions shown and assumes no responsibility therefore, it shall be the responsibility of the Contractor to visit the site and verify all existing conditions prior to bid.

The Owner will purchase certain items required for the overall operation of this facility through outside vendors.

The Contractor(s) will cooperate with said vendors as may be necessary to permit the work to be accomplished.

a. The cooperation may extend to the receiving, unloading and placement of said equipment if directed by the Owner.
b. Each Contractor is advised that the Owner may enter into separate contracts as may be in their best interest.
c. Each Contractor is further advised that there will be a full on-site Project Representative / Construction Manager, whose duties will be defined at the pre-construction meeting.

ADDITIONAL SECURITY PROVISIONS.

1. All Contractors’ employees shall use a single means of access and egress, except in the case of emergency, to be designated by the Construction Manager.

2. Each Contractor and each Subcontractor shall require his employees, while on the job site, to wear, in a conspicuous location, a photo I.D. button bearing the name of the employee and the Contractor. The buttons of each Contractor shall be numbered consecutively. An up-to-date list of all I.D. buttons, indicating the name and number for each employee, shall be furnished to the Construction Manager.

1.12 ASBESTOS AND LEAD PAINT AWARENESS REQUIREMENTS

Contractor agrees not to use or permit the use of any asbestos containing material in or on any property belonging to the Owner.

For purposes of this requirement, asbestos free shall mean free from all forms of asbestos, including - actinolite, amosite, anthrophyhllite, chrysotile, cricidolite and tremolite, both in friable and non-friable states and without regard to the purposes for which such material is used.

1.13 CONSTRUCTION TIME AND PHASING REQUIREMENTS

Each Contractor is advised the “time is of the essence” of the Contract as defined in the “General Conditions” for the completion of the construction of the facility.
It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship.

Time of Completion shall be as established in the Milestone Schedules (Section 011100).

The Contractor shall maintain fences and barricades at all times and shall repair/ restore and/ or pay for any temporary fencing damaged by their work.

Maintain at all times, all exits and walkways.

Where the barricade is removed for work, the Contractor performing such work shall provide adequate safety personnel to prevent unauthorized persons from approaching the work area.

Construction Phasing

The phasing and/ or milestone schedule contained in Section 011100 has been established for the overall construction of the project.

Electrical and mechanical services to the functioning spaces shall be maintained at all times.

Swing-overs to new facilities shall be made so as to cause the least interruption to the facilities’ operations.

1. The Contractor shall provide and maintain all required separations between old and new construction to prevent: Unauthorized entrance to construction areas by others than Architect, Construction Manager, or Owner, heat loss from existing building, water (rain or ground) infiltration into existing building.
2. Exterior alteration and restoration, as required, may proceed outside of phasing schedule at the Contractor’s option with concurrence from the Architect, Construction Manager and Owner.
3. Site development work shall proceed in such a manner to cause the least amount of disruption to the ongoing operations as possible.

1.14 PROOF OF ORDERS, DELIVERY DATES AND SUPPLY CHAIN TRACKING - Coordinate with Sections 013300 and 013216.

Within 2 weeks after the approval of shop drawings, samples, product data and the like, the Contractor shall provide copies of purchase orders for all equipment and materials which are

not available in local stock. The Contractor shall submit written statements from suppliers confirming the orders and stating promised delivery dates. Failure to provide this critical information will result in Owner holding monthly requisition payments until received.

Due to COVID-19 and it's potential to disrupt material supply-chains, the contractors are required to obtain all materials for the project and store them onsite in their individual Conex boxes. This includes general material items typically readily available (piping, conduits, wire, metal studs, ceiling, etc.). The owner will pay for these stored items delivered to the jobsite in accordance with Section 012900.

This information shall be incorporated within the progress schedules so required as part of Section 013216 and 013300 and shall be monitored so as to ensure compliance with promised dates.

1.15 FIELD MEASUREMENTS

Each Respective Contractor shall take all necessary field measurements prior to fabrication and installation of work and shall assume complete responsibility for accuracy of same.

1.16 INITIAL SUBMITTAL REQUIREMENTS

As outlined in Division 01, each Contractor shall provide items noted including - bonds, insurance, emergency telephone numbers, progress scheduling, schedules of submittals, subcontractor listings and the like prior to the start of any work. The owner will not issue contracts until all bonds and insurance information is received by the contractor and verified correct.

1.17 SCHEDULES

The milestone schedule presented in the documents is for bidding and general purposes. Due to the nature of the work, it is the intention of the Construction Manager to negotiate actual work periods for the project among the various Prime Contractors involved with this bidding process, as well as separate contractors involved with other phases of the work solicited under separate proposals. Each Contractor shall, under terms of the General Conditions, mutually cooperate in the rescheduling of work to permit an uninterrupted use of the facilities by the Owner, without additional cost to the Owner.
General:

1. The objective of this project is to complete the overall work in the shortest period of time and to protect the building and occupants from damages caused by weather and construction activity during the progress of the work.
2. To meet these objectives, the Contractor shall plan the work, obtain materials, and execute the construction in the most expeditious manner possible in accordance with the requirements listed below.
3. **The work will proceed through the winter months and as such contractors shall include ALL winter related construction costs in their base bid.**

4. If the Contractor fails to expedite and pursue any part of the work, the Owner may terminate the contract or may carry out the work with others per the General Conditions.
5. The Contractor shall work in coordination with work of other Contractors and Owner
6. All contractors are required to comply with proper sequencing of work and provide other prime contractors sufficient time to install their work (e/g/-metal stud walls get fully framed; MEP contractors perform roughing/testing/inspections; then walls are sheathed with gypsum – no sheetrocking one side unless CM approved). If contractor "boxes out" another prime contractor, he will be directed to stop work and open if necessary, to enable other trades to complete their work. No compensation for lost time due to stop-work will be provided.

Milestone Schedule (See Section 01 11 00).

1.18 ADDITIONAL REQUIREMENTS

The following are additional general and special requirements which will govern the work of the projects covered by these Documents.

1. If it appears that some of the work cannot be completed by the scheduled date, the Contractor shall increase the work force or increase the hours of work, including evenings and weekends as necessary, and cover any additional costs to the Owner, architect and Construction Manager.
2. If the work is complete but the area is not cleaned and debris or equipment is not removed, the Owner shall have the right to prepare the area for occupancy with his own forces and deduct the costs from the Contract Amount. (If Contractor does not respond within 4 hours' notice).
3. If the Contractor fails to staff the job adequately to meet the completion date, the Owner reserves the right to assume possession of the material and complete installation with the Owner's forces or other Contractors or to require the Contractor to work evenings and weekends at no additional cost.
4. The jobsite may be made available on weekends and evenings to allow the Contractor additional time to complete the work before final completion date. Any custodial or Construction Manager costs resulting in this after-hours scheduling will be the Contractor's responsibility as their contractual hourly rate.
5. Work in each work period shall progress at least at a pace in proportion to the Contract time available.
6. The Contractor is responsible for temporary protection of all work until acceptance.
7. All existing conditions must be verified in the field. The Owner takes no responsibility for actual conditions found deviating from the drawings. If existing condition interferes with contract work, contractor is responsible to eliminate this condition.
8. Contractor must plan, provide and maintain his own access, ramping, and egress as required into and out of the site, staging of trailer(s), materials, machinery, and equipment in agreement with the Construction Manager's Superintendent. Maintain free and safe access on the jobsite for other related project personnel. Maintain

safe pedestrian or vehicular traffic must be regulated by a flagman. Trucking and delivery operation should be coordinated with Construction Manager's Superintendent and all other trades.

9. Contractor is responsible for all work shown on Contract Documents, including drawings of other trade disciplines. For example, the HVAC Contractor will be responsible for HVAC work shown on Architectural Drawings.
10. Contractor is responsible to maintain existing site fencing in its existing condition. Modifications to the fence to better accommodate the contract work can be discussed with the Construction Manager. These changes shall then be handled by this contractor at his expense and in accordance with the Construction Manager's Superintendent's direction. Any cost incurred as a result of damages shall be charged to this contractor.
11. Contractor's personnel will not be permitted to use Bedford Fire Departments facilities (including toilet, telephone, food services, etc.) for their own benefit. Contractors' Superintendent must explain this to all their field forces.
12. Time is of the essence. Contractors' proposed schedule must be approved by the Construction Manager. Contractor shall indicate significant events such as submittals, shop drawings, material ordering, fabrication, delivery, coordination precedents, installation, testing and turnover by area or system as agreed with Construction Manager. A revised progress status shall be required on a weekly basis.
13. Decisions required from the Construction Manager, Architect and/or Engineer, shall be anticipated by the Contractor to provide ample time for inspection, investigation or detailed drawings.
14. Contractor shall limit his operations including storage of materials and prefabrication to areas within the Contract Limit Lines unless otherwise permitted by the Construction Manager at the Owner's option.
15. Contractor shall coordinate the use of premises with the Owner and Construction Manager and shall move at his own expense any stored products under Contractor's control, including excavated material, which interfere with operations of the Owner or separate contractors.
16. Contractor shall obtain and pay for the use of additional storage of work areas needed for operations.
17. Contractor shall assume full responsibility for the protection and safekeeping of products under this Contract stored on the site and shall cooperate with the Construction Manager to ensure security for the Owner's Property.
18. The intention of the work is to follow a logical sequence; however, the Contractor may be required by Construction Manager to temporarily omit or leave out any section of his work, or perform his work out of sequence. All such out of sequence work and come back time to these areas shall be performed at no additional cost.
19. Contractor shall submit a three-week schedule (man-loaded by work activity and area) to Construction Manager each week. Contractor's representative shall attend a weekly meeting with all contractors, chaired by Construction Manager, for the purpose of job coordination and sequencing. Contractor is responsible to coordinate the job with other trades and Construction Manager, and to cooperate with other

trades in pursuit of the overall project's shop drawings and actively participate in resolving discrepancies, conflicts, interferences, etc.

20. Each Prime Contractor shall prepare an overall job schedule for his portion of work upon award of Contract, as per section 013216 - Construction Progress Schedule.
21. Sufficient manpower shall be provided at all times to maintain progress of the job. A shortage of labor in the industry shall not be accepted as an excuse for not properly manning the job.
22. The contractor shall take special care in verifying that his equipment matches the characteristics of the power being supplied.
23. Any contractor personnel including project managers, supervisors, etc. who engage in any personal attacks, belligerent or threatening speech/texts, etc., to the owner, or any of its agents, will be removed from working on the project.
24. Insubordination, unsafe practices, horseplay, abusive behavior or language, wanton destruction of property, use of drugs or alcohol, possession of firearms, and solicitation shall not be tolerated. There will be no warnings, and Contractor shall designate a responsible on-site supervisor to handle any situations that may arise, including termination.
25. Each contractor is responsible to supply and install all wood blocking/bracing necessary to properly secure their work. This responsibility includes coordinating the installation in concealed areas without delaying other trades.
26. Union business shall not be conducted on site. Any Union representatives that visit the site must declare what Contractor's personnel they represent, and must be escorted by that Contractor's Union steward at all times. No visitors, sales representative or non-working personnel shall be permitted on site without prior consent of the Construction Manager. No photographs shall be taken without the Construction Manager's prior approval.
27. Organize daily clean ups as well as participating in a weekly joint clean up involving all prime contractors onsite. Clean up shall be considered a safety issue. If any contractor fails to keep the site safe and brook clean within 4 hours of being notified by the Construction Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed by others and will back charge accordingly.
28. Contractor shall provide protection from damage to adjacent and adjoining work and/or structures. Contractor shall clean, repair and/or replace any damage for which this contractor is responsible.
29. Contractor shall submit hourly rate sheets that would apply to time and material work for all pertinent trades upon Award of Contract.
30. Contractor shall examine surfaces and conditions prior to start of work. Report unacceptable conditions to the Construction Manager. Do not proceed until unacceptable conditions are corrected and acceptable. Starting of work implies acceptance.
31. Upon removal of exterior walls and window units, the building security and weather protection is the responsibility of the prime contractor performing the removals.
32. Each Prime Contractor shall include general housekeeping of light debris. All debris from each Prime Contractor will be collected daily and disposed of into their

dumpsters. **In addition to daily general housekeeping, the General Work Contractor (Contract #1) shall provide a weekly broom sweep and damp mop of all areas for the entire duration of the project**. The broom sweep shall include debris from all trades working on site.

33. It is the responsibilities of all Prime Contractors to review the entire summary of work and remaining documents for additional work items.
34. SLEEVES AND SLEEVE LAYOUT - It is the responsibility of the Prime Contractor requiring a sleeve to provide the sleeve and a layout sketch to the Prime Contractor performing the construction activity that the sleeve goes in.
35. Each contractor is responsible to review and become familiar with the scope of work included in all Contracts.
36. Limited site space is available in areas as designated by the Construction Manager. Construction trade parking is not permitted in Owner's employee parking lot.
37. Each contractor shall provide the engineering layout required to properly complete his work from an established working point. Contractor shall employ only competent engineering personnel skilled in performing layout tasks of similar complexity.
38. Prior to commencing the work, each Contractor shall provide written acceptance of grades, structures, substrates, and/or systems installed by other Contractors as suitable for installation of his work. Failure to provide this verification prior to commencing work shall constitute acceptance of the existing conditions.
39. Each Contractor shall coordinate with the Construction Manager for lay down areas, staging areas, and overall use of project site.
40. All contractors and their employees, subcontractors and supplier are expressly prohibited from entering the occupied areas of the school buildings during school hours without prior written permission of the Construction Manager and for using any of its facilities (i.e. restrooms, cafeteria, etc.).
41. Each contractor is responsible for the timely provision of the information required by other Contractors for the progress of other Contractors' work.
42. All contractor foremen must have working cell phone and number provided to CM.
43. No recycled import fill materials are permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

SECTION 01 11 00 - MILESTONE SCHEDULE

PART1 - GENERAL

1.1 MILESTONE

a. The following milestone schedule serves as a basis for bidding. A Master Schedule will be developed at a general meeting with each the low bidder within 21 days of Letter of Intent to Award the Contracts. Each prime contractor will coordinate activities, forward submittals, deliver materials and provide necessary manpower to meet the milestones listed below.

1.2 MILESTONE SCHEDULE

Bedford Fire Department Project	Start	Finish
• Sitework start	NTP	----------
• Tree Cutting & Removal	-------	04/23/2021
• Proof Roll after Rough Grading	--------	05/28/2021
• Building Start	6/1/2021	----------
• Administration Shell Complete & Watertight	--------	11/01/2021
• Main Building Shell Complete & Watertight	-------	11/29/2021
• Site & Underground Utilities (winter sitework shutdown)	--------	11/01/2021
• Building Substantially Complete	--------	06/10/2022
• 2nd Floor Completion (Alternate if selected)		07/15/2022
• Curbs / Sidewalks / Paving / Landscaping	04/04/2022	06/17/2022
• Final Closeout		07/15/2022

Contractor is specifically notified that they will need to work multiple crews simultaneously in order to meet the production rates to complete the work (M-F work week) by the above completion dates.

Due to space limitations at the jobsite, all Prime Contractors are specifically notified that jobsite material lay-down areas will need to be relocated as necessary in order to permit the Sitework contractors' installations. (Sitework contractor will need to progress his installation accordingly to allow lay down areas for the other Prime contractors). All contractors are required to comply with Construction Managers direction and sequencing.

Contractors are specifically notified that they must properly man the project with a competent full time field superintendent and a sufficient supply of tradesmen to maintain progress and flow of work as required by schedule and to coordinate/install timely for other trades. The work will proceed through the winter months and as such contractors shall include ALL winter related construction costs in their base bid.

The objective of this project is to complete the overall work in the shortest period of time. Thus, if access is provided to a work area sooner than originally scheduled, each contractor will likewise mobilize their forces earlier to maintain the reduction in overall schedule time.

Each Contractor is advised that “Time is of the essence” as per the AIA 232 General Conditions and they will work with multiple crews of sufficient size as necessary to carry out the work with the utmost speed with good workmanship. If the contractor fails to expedite and pursue any part of the work, the Owner may order the contractor to take “extraordinary measures” or hire others to complete the work and adjust their contract amount accordingly as per the contract

All work required by any of the Owner's representatives and consultants, including the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc., to execute final the contract beyond Milestone dates, or to executed final closeout after 30 days past substantial completion, if determined to be caused by contractor, shall result in payment(s) to the Owner for additional services to the Construction Manger, Architect, Architect's consultants, Owner's Attorneys, etc. These costs will then be issued in the form of a deduct change order to the contractor’s contract at the Owners consultant’s contractual rate.

PRODUCTS (Not Applicable)

EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

a. Contingency allowances.

b. Material allowances.

C. Related Sections: The following Sections contain requirements that relate to this Section:

a. Division 1 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.

b. Division 1 Section "Quality Control Services" specifies procedures governing the use of allowances for inspection and testing.

c. Division 1 Section “Unit Prices” specifies amount to be added / deducted for identified item.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.5 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed for the Owner's purposes and only by a formal Allowance Disbursement that indicate amounts to be charged to the allowance.
B. **The Contractor's overhead and profit, including costs for bonds and insurance, delivery, equipment rental and similar costs, for these allowances shall be included in the values of the general requirements of contract sum and are not chargeable under allowance disbursement.**
C. At Project closeout, credit unused amount remaining in the contingency & quantity allowances to the Owner by Change Order.

1.6 UNUSED MATERIALS

A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted. When requested by the Architect, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Architect, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.
B. Any unused allowances will be credited back to the owner per the unit price in the contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. <u>CONTRACT #1 – Sitework Contractor</u>:

Allowance SC-1: Contractor shall include a contingency allowance of **$ 75,000.00** for use according to the Owner’s Instructions.

Allowance SC-2: Unsuitable Soil: Contractor shall include in their base bid an allowance of 150 cy for removal of unsuitable soil material and replace with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place)

B. <u>CONTRACT #2 - General Work Contractor</u>

Allowance GC-1: Contractor shall include a contingency allowance of **$ 125,000.00** for use according to the Owner's Instructions.

Allowance GC-2: Unsuitable Soil: Contractor shall include in their base bid an allowance of 150 cy for removal of unsuitable soil material and replacement with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place)

C. CONTRACT #3 – Mechanical Contractor:
Allowance MC-1: Contractor shall include a contingency allowance of **$45,000.00** for use according to the Owner's Instructions.

D. CONTRACT #4 – Electrical Contractor:
Allowance EC-1: Contractor shall include a contingency allowance of **$45,000.00** for use according to the Owner's Instructions.

E. CONTRACT #5 – Plumbing Contractor:
Allowance PC-1: Contractor shall include a contingency allowance of **$30,000.00** for use according to the Owner's Instructions.

F. CONTRACT #6 – Fire Protection Contractor:
Allowance FPC-1: Contractor shall include a contingency allowance of **$20,000.00** for use according to the Owner's Instructions.

END OF SECTION

SECTION 01 22 00 – UNIT PRICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for measurements and records made for payment purposes and describes the item(s) under which payment(s) will be made for the Work performed under this Contract.

B. All work shown or specified in the Contract Documents shall be performed.

C. Items not specified to be measured or paid for (for which no specific pay item exists in the Price Schedule) shall be included in an appropriate unit price item or in a lump-sum item.

1.2 MEASUREMENT REQUIREMENTS

A. All required measurements shall be made by the Contractor with the Construction Manager and Engineer.

B. Any measurements not witnessed by Construction Manager and which cannot be verified or substantiated will not be approved and payment under the item(s) requiring such measurements will not be made.

C. Coordinate measurements as necessary, for the preparation of periodic pay estimates.

D. Where payments will be made for removing and replacing existing materials, notify Construction Manager so that he may witness the measurements.
   1. All materials removed without conforming to the above procedures, which Construction Manager cannot verify or substantiate, will not be paid for.
   2. Maintain complete, neat, clean, and legible field notes for all measured items.
   3. Field measurement notes shall contain spaces for Contractor's and Construction Managers signatures plus additional space for comments.
   4. Field measurement notes and supporting photos shall be turned over to Construction manager daily.
   5. The Construction Managers signature shall not be constituted as an acceptance of the work, or the measurements made, but shall mean that he was present when the measurements were made.

1.3 SUBMITTALS

A. See Section 013300.

B. Field notes of all measurements for payment purposes delivered to Construction Manger daily.

C. Copies of all invoices required for payments out of cash allowance(s).

D. Monthly Applications for Payment.

E. Record Drawings showing the locations and quantities of all items measured for payment purposes.

1.4 SCHEDULING

A. Notify Construction Manager, as far in advance as possible, of the recording of measurements so that they may observe existing conditions, work being performed, and measurements being made.

B. Allow for and afford Construction Manager ample time, space, and equipment to observe measurements and to verify measurements and elevations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to properly and accurately perform all measurements for payment purposes.

B. Payment for certain items not specifically listed in the bid forms but otherwise required by the technical specifications shall be deemed included as part of the General Conditions and the individual unit price and lump sum bid items provided for in the proposal.

C. The Contractor's overhead and profit, including costs for bonds and insurance, delivery, equipment rental and similar costs, for these unit prices shall be included in the values of the unit prices and are not chargeable separately.

PART 3 – EXECUTION

3.1 GENERAL

A. Perform all measuring required under this Section.

B. Record all measurements and calculated quantities on the Record Drawings.

C. No measurement shall be made for work performed within the limits of Lump Sum Items.

3.2 UNIT PRICE SCHEDULE

Contract # 1 Sitework Contractor

1. Unit Price SC1: Replacement of Unsuitable Soil Material
   a. Description (Unit price cost): Provide all labor, material and equipment to remove unsuitable soil material under unclassified excavation (proper disposal offsite) and install imported structural backfill material placed and compacted, to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
   b. Verification of quantity by CM.

c. Unit of Measurement: per cubic yard in place.

Contract # 2 General Contractor

2. Unit Price GC1: Replacement of Unsuitable Soil Material
   a. Description (Unit price cost): Provide all labor, material and equipment to remove unsuitable soil material under unclassified excavation (proper disposal offsite) and install imported structural backfill material placed and compacted, to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
   b. Verification of quantity by CM.
   c. Unit of Measurement: per cubic yard in place

Contract # 3 Mechanical Contractor

Unit Prices – None

Contract # 4 Electrical Contractor

Unit Prices – None

Contract # 5 Plumbing Contractor

Unit Prices – None

Contract # 6 Fire Protection Contractor

Unit Prices – None

See Bid forms

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submission procedures.

B. Documentation of changes to Contract Sum/Price and Contract Time.

1.2 RELATED SECTIONS

A. Proposal Form.

B. Other sections referencing this section.

C. All contractual requirements outlined in the documents.

1.3 SUBMISSION REQUIREMENTS

A. Submit Alternates on Proposal Forms identifying the effect on adjacent or related components.

B. Alternates will be reviewed and accepted or rejected at the Owner's option.

C. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.4 SELECTION AND AWARD OF ALTERNATES

A. Indicate variation of Bid Price for Alternates listed on the PROPOSAL FORM. This form requests a "difference" in Bid Price by adding to or deducting from the base Bid Price.

B. Alternates quoted on PROPOSAL FORM will be reviewed and accepted or rejected at Owner’s option.

C. Accepted alternates will be identified in Owner-Contractor Agreement.

D. Bids will be evaluated on the base bid price, plus any combination of alternate items.

1.5 WORK FOR ALTERNATES

A. Work for alternate items selected shall include all related materials, labor, equipment and operations necessary to conduct and complete the alternate work and all other affected work or adjacent areas.

B. There shall be no change in time or completion date for the selected alternates, unless specified herein or approved in writing by the Architect/Engineer and Owner.

C. Alternates and associated work shall meet all standards and specifications delineated in the Contract Documents.

D. Contractor shall coordinate pertinent related Work and modify surrounding Work as required to complete the project under each alternate selected by the Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

A. Work for each alternate, related items and collateral work shall be completed in their entirety.

B. If alternate items are not selected, work for the base bid and collateral work shall be completed in their entirety.

C. Schedule of Alternates

See bid forms for Alternate information

END OF SECTION

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
   1. Provisions of this Section apply to the work of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
   2. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
   3. Division 1 Section "Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

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

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
   2. Within 10 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
      a. Include an itemized list of quantities of products required and unit costs, with the total amount of purchases to be made. Furnish survey data and backup invoices, quotes paperwork to substantiate.
      b. Separate labor hours by trade and indicate labor rate. (Submit attached labor rate worksheet notarized for each trade / classification.)
      c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

d. Include an updated Contractors Construction Schedule that indicates the effect of the change, including but not limited to; changes in activity duration, start and finish times, and activity relationship. Use available float before requesting an extension of contract time.

B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include an itemized list of quantities of products required and unit costs, with the total amount of purchases to be made. Furnish survey data to substantiate quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.
4.
a. Include an updated Contractors Construction Schedule that indicates the effect of the change, including but not limited to; changes in activity duration, start and finish times, and activity relationship. Use available float before requesting an extension of contract time.

C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in the purchase amount only where indicated as part of the allowance.
2. When requested, prepare explanations and documentation to substantiate the margins claimed.
3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
Separate labor hours by trade and indicate labor rate. (Submit attached labor rate worksheet notarized for each trade / classification.)
4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
5. Contractor’s overhead and profit, including costs for bonds & insurances, for these allowances shall be included in the values of the general requirements of contract sum and are not chargeable under allowance disbursement.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 15 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 15 days.
   1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
   2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714/CMa. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Architect or Construction Manager will issue a Change Order for signatures of the Owner, Architect, Construction Manager and the Contractor on AIA Form G701.

B. Contractor cannot requisition for any allowance or change order work until the paperwork has been fully executed by the Contractor, CM, Architect and Owner.

C. Requests for changes in bond fees, if any, will be analyzed at the conclusion of the project. Contractors bonding company to submit substantiation. (Bond amount based on total adjusted contract value)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

LABOR RATE WORKSHEET

Project No. _____

Contractor Name: _____ County: _____ Date: _____
Address: _____
_____
Telephone Number: _____

Trade: _____
(Provide separate sheet for each trade, foreman/journeyman, etc.)

				REGULAR BASE RATE	PREMIUM TIME BASE RATE
A. WAGE RATE PER HOUR					
BENEFITS (* Identifies benefits paid directly to the Employee.)	*	% per hour	$ per hour		
Vacation and Holiday					
Health and Welfare					
Pension					
Annuity					
Education / Apprentice Training					
Supplemental Unemployment					
Security Fund					
Industry Advancement					
UBC-Appr., Health, Safety, Educ.					
Labor Management Fund					
B. TOTAL BENEFITS PER HOUR					
PAYROLL TAXES AND INSURANCE					
F.I.C.A. / Social Security (up to the maximum required by law)			%		
Medicare			%		
Federal Unemployment (up to a maximum of $56.00 per employee per year)			%		
State Unemployment (up to 1st $8,500 of base salary paid per employee per year)			%		
Workers' Compensation Code: _____			%		
Disability			%		
C. TOTAL TAXES AND INSURANCE PER HOUR					
All Benefits are paid directly to Employee. Only benefits identified by * are paid directly to Employee.		_____ x _____ % =			
D. TOTAL LABOR RATE			(A + B + C) =		

E. DOCUMENTATION

For General Liability and Workers Compensation, provide policy renewal page from insurance carrier (with contractor name, address, and insurance agent) for substatiation purposes.

F. CONTRACTOR'S CERTIFICATION

I certify that the labor rates, insurance enumerations, labor fringe enumerations and expenses are correct and in accordance with actual and true cost incurred.

_____
Signature

_____
Print Name of Authorized Representative

_____
Print Title

Sworn before me this _____ day

of _____ , 20 _____.

_____
Notary Public

SECTION 01 29 00 - PAYMENT & MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

a. This Section specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.
    1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
b. Related Sections: The following Sections contain requirements that relate to this Section.
    1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.3 SCHEDULE OF VALUES

a. Coordination: Contractor shall coordinate preparation of its Schedule of Values for the Work with preparation of the Contractors' Construction Schedule.
    1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
        a. Contractor's Construction Schedule
        b. Application for Payment forms, including Continuation Sheets
        c. List of subcontractors
        d. Schedule of allowances
        e. Schedule of alternates
        f. Schedule of submittals
    2. Submit the Schedule of Values to the Construction Manager within 10 days of receipt of Letter of Intent but no later than 10 days before the date scheduled for submittal of the initial Applications for Payment. (SOV's received after the 15th of the month, will not be allowed to requisition until the following month, due to input time for CM & Owner into their computer systems.
b. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
    1. Identification: Include the following Project identification on the Schedule of Values:
        a. Project name and location.
        b. Name of the Architect.
        c. Project number.
        d. Contractor's name and address.
        e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
      1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items where requested by Construction Manager. Multiple line items will be provided for amounts in excess of five percent of the contract sum, broken out into sub components equaling not greater than five percent each. Separate all line items by material & labor.
   a. Breakdown shall be separated between additions and renovations with subtotals for each.
4. In addition to the breakdown of specification sections, separate line items will be required for the following front-end line items:
   a. Bonds & OCP insurances to have separate line items. (Substantiation letters required from bonding & insurance company for any amounts higher than industry standard). Only OCP insurance allowed for insurance line item. All other insurance costs must be distributed by contractor throughout the various sections.
   b. Supervision - include a minimum of one percent of contract sum.
   c. Project Administration - include a minimum of one percent of contract sum.
   d. Project meetings (appropriate value for weekly attendance for entire duration of project - see Section 01 31 19 Project Meetings for amount)
   e. Punchlist - include a minimum of .5 percent of contract sum
   f. Closeout: separate lines for demobilization, Operation & maintenance manuals, closeout paperwork, demonstration & training (total for closeout minimum two percent of contract value)
   g. Continuous Clean-up and Final Clean-up values each at minimum of .5%
   h. General Contractor to add line item for Broom sweep/damp mopping
5. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
6. 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. Include requirements for insurance and bonded warehousing.

7. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.
9. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
10. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

a. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
    1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
b. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
c. Payment-Application Times: The date for each progress payment is the 21st day of each month (or as designated by the Owner). The period covered by each Application for Payment is the previous month.
d. Payment-Application Forms: Use AIA Document G732/CMa (include line for Construction Manager signature) and Continuation Sheets G703 as the form for Applications for Payment.
    1. Separate Continuation Sheets shall be provided for work which takes place on each building, which will detail that portion of the contract which is attributable to the specific building.
e. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Construction Manager will return incomplete applications without action.
    1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders and Allowances issued prior to the last day of the construction period covered by the application. (<u>No Change Order or Allowance requisitions can be made or listed on the requisition, unless the formal CO/AD</u>

paperwork has been **fully executed** by Contractor, Construction Manager, Architect and Owner).

3. Provide copies of payrolls which are signed and notarized documenting compliance with prevailing wage laws. Payroll for contractors is required from the 25th of the previous month to the 24th of the current month. Payroll for subcontractors is required from the 15th of the previous month to the 14th of the current month.
4. Provide copies of lien waivers for the previous payment (or anticipated payment). Include certificate of monthly payment for subcontractors for the previous month.
5. Provide OSHA 10 certificates for all workers on site.
6. Payment for stored materials (whether onsite but not installed, or offsite in a secured warehouse) will require a bill of lading showing the exact value and photographs. In no case shall more than 90% be approved for uninstalled stored materials. An Insurance certificate must be provided, specific to the materials stored with the appropriate dollar value (for onsite or offsite materials).

f. Transmittal: Submit 5 signed and notarized original copies of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. Each copy shall be complete, and securely attached to include all waivers of lien, certified payrolls and similar attachments.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect and Construction Manager.

g. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.
   1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
      a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   4. Waivers Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

h. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment include the following. The initial payment application will not be processed until all of these actions and submittals have been received by the Construction Manager. When preliminary submissions are received with the initial application (items 4 and 7), the final submission for these items must be received and approved by the Construction Manager prior to submission of the second application for payment.
   1. List of subcontractors.

2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of principal products.
6. Schedule of unit prices.
7. Submittal Schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. Copies of building permits.
10. Copies of authorizations and licenses from governing authorities for performance of the Work.
11. Initial progress report.
12. Report of preconstruction meeting.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire the Owner's insurance.
16. Initial settlement survey and damage report, if required.

i. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
   1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
   2. Administrative actions and submittals that shall precede or coincide with this application include:
      a. Occupancy permits and similar approvals.
      b. Warranties (guarantees) and maintenance agreements.
      c. Test/adjust/balance records.
      d. Maintenance instructions.
      e. Meter readings.
      f. Startup performance reports.
      g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
      h. Final cleaning.
      i. Application for reduction of retainage and consent of surety.
      j. Advice on shifting insurance coverages.
      k. Final progress photographs.
      l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

j. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Ensure that unsettled claims will be settled.
   4. Ensure that incomplete Work is not accepted and will be completed without undue delay.

5. Transmittal of required Project construction records to the Owner.
6. Certified property survey.
7. Proof that taxes, fees, and similar obligations were paid.
8. Removal of temporary facilities and services.
9. Removal of surplus materials, rubbish, and similar elements.
10. Change of door locks to Owner's access.

PART 3 - EXECUTION

3.1 No retainage release will be approved by owner until all closeout documents (Closeout paperwork, as-builts, O & M manuals, AIA release forms, warranties, material turnover receipts, etc.) are received and verified complete.

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2.5 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination Drawings.
   4. Administrative and supervisory personnel.
   5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and pre-installation conferences.
   2. Division 1 Section " Construction Progress Schedule" for preparing and submitting the Contractor's Construction Schedule.
   3. Division 1 Section "Materials and Equipment" for coordinating general installation.
   4. Division 1 Section "Execution and Closeout Requirements" for coordinating contract closeout.

3.5 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.
   4. Contractor is required to coordinate with their subcontractors, other Prime contractors and the Construction Manager, ahead of the work progressing.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Processing of submittals and photocopying/delivery to affected contractors.
   4. Progress meetings.
   5. Project closeout activities.

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

4.5 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components. (e.g. – subslab piping, ceiling spaces, etc.)
   1. Show the relationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements contained in Section "Submittals."
   4. HVAC Contractor will begin coordination drawing process within 15 calendar days of award of Contract by providing ¼" scale drawings indicating locations of all ductwork layout, piping layout, Bottom of duct etc. Electronic copies will then be forwarded to the Plumbing Contractor for their piping input, then submitted to Electrical Contractor for lighting fixtures, main feeders and clearances. Finally, to the General Contractor for ceiling information (Each contractor shall complete their review and mark-ups within 5 days)
   5. A coordination meeting with all Contractors and subcontractors to review completed coordination drawings will be held within 45 days of Contract award.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1.
   2. Electronic CAD Files of Project Base Plan Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
   3. Electronic CAD files of Project Drawings: Distributed only under the following conditions:
      a. Use of files is solely at receiver's risk. Architect/Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Architect/Engineer of discrepancy and use information in hard-copy Contract Drawings and Specifications.
      b. CAD Files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and

complying with these conditions and for incorporating addenda and modifications.

c. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.

d. Receiver shall not hold Architect/Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.

e. Receiver shall understand that even though Architect/Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.

1) Receiver shall not hold Architect/Engineer responsible for such viruses or their consequences, and shall hold Architect/Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

4. Upon request to the Architect, and at the Architect's sole discretion, Base Plan Drawings only may be provided to the Prime Contractor in electronic format (for example, AutoCAD format) by the Architect at a charge rate to cover the architect's cost for producing.

5. Prior to the Architect's dispensing of documents in electronic format, the Contractor shall execute and deliver an "Electronic Media Release Agreement," provided upon request by Architect, along with said payment.

C. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

1.5 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

2.5 CLEANING AND PROTECTION

A. Prime Contractor is to clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
   1. Excessive static or dynamic loading.
   2. Excessive internal or external pressures.
   3. Excessively high or low temperatures.
   4. Thermal shock.
   5. Excessively high or low humidity.
   6. Air contamination or pollution.
   7. Water or ice.
   8. Solvents.
   9. Chemicals.
   10. Light.
   11. Radiation.
   12. Puncture.
   13. Abrasion.
   14. Heavy traffic.
   15. Soiling, staining, and corrosion.
   16. Bacteria.
   17. Rodent and insect infestation.
   18. Combustion.
   19. High-speed operation.
   20. Improper lubrication.
   21. Unusual wear or other misuse.
   22. Contact between incompatible materials.
   23. Destructive testing.
   24. Misalignment.
   25. Excessive weathering.
   26. Unprotected storage.
   27. Improper shipping or handling.
   28. Theft or vandalism

3.3 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI and forward to the Construction Manager via the internet web-based service.
   1. RFI's shall originate with Contractor. RFI's submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project Name.
2. Date.
3. Name of Contractor.
4. Name of Architect and Construction Manager.
5. RFI number, numbered sequentially. Use prefix based on Contract (i.e. MC, EC).
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractors Signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies and attachments.

C. Architect's Action: Architect will review each RFI, determine action required, and return it.
1. The following RFIs will be returned without action:
    a. Requests for approval of substitutions.
    b. Requests for coordination information already indicated in the Contract Documents.
    c. Requests for adjustments in the Contract Time or the Contract Sum.
    d. Requests for interpretation of Architect's actions on submittals.
    e. Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

D. On receipt of Architect's and Construction Manager's action, immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

3.4 DEFICIENCY REPORTS

A. If the owner, Architect, or Construction Manager notes a deficiency in an installation, material, etc. they will issue a deficiency report via the internet web-based service to the appropriate contractor. The contractor has 2 weeks to correct the deficiency and upon completion must respond back in Primavera. The A/E will then perform a follow- up inspection to confirm that the deficiency was adequately corrected.

3.5 Department of Labor Overtime Request

A. The DOL overtime request form shall be filled out and forwarded by each contractor to the Construction manager prior to the start of any onsite work. (See Div 0 for form) Contractors will not be allowed to work Weekends or after hours unless the DOL has been properly notified.

END OF SECTION

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Preconstruction conferences.
2. Preinstallation conferences.
3. Progress meetings.
4. Coordination meetings.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating project meetings with other construction activities.
2. Division 1 Section "Submittals" for submitting the Contractor's Construction Schedule.

1.3 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference will be scheduled before starting construction, at a time convenient to the Owner, Construction Manager and the Architect, but no later than 15 days after issuance of the Letter of Intent. The conference will be held at the Project Site or another convenient location.

B. Attendees: Authorized representatives of the Construction Manager, Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Tentative construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.

6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data, and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Parking availability.
11. Office, work, and storage areas
12. Equipment deliveries and priorities.
13. Safety procedures.
14. First aid.
15. Security.
16. Housekeeping.
17. Working hours.

D. Reporting: CM shall prepare and issue minutes to attendees and interested parties.

1.4 PREINSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction.

B. Attendees: The Installer and representatives of the Prime Contractor, manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Construction Manager and Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related Change Orders.
d. Purchases.
e. Deliveries.
f. Shop Drawings, Product Data, and quality-control samples.
g. Review of mockups.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's recommendations.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities.
q. Space and access limitations.
r. Governing regulations.
s. Safety.
t. Inspecting and testing requirements.

u. Required performance results.
v. Recording requirements
w. Protection.

2. Record significant discussions and agreements and disagreements of each conference and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.
4. Reporting: Prime Contractor or Installer shall issue minutes to attendees, CM, Owner and Architect.

1.5 PROGRESS MEETINGS

A. Progress meetings will be held at the Project Site at regular intervals (typically weekly) as determined by the Construction Manager.

B. Attendees: In addition to representatives of the Owner, Construction Manager, and the Architect, each Prime Contractor shall be represented at these meetings. Attendance is mandatory at meetings and contractor will include in their bid a sum of $250.00 per meeting (figure 35 meetings) to have an authorized individual in attendance capable of making decisions and providing direction. This amount will be listed as a separate line item on the contractors Schedule of Values. If the contractor misses a meeting without prior written authorization from the Construction Manager, they will be issued a deduct change order in the amount of $250.00 per occurrence. Subcontractors, suppliers, or other entities will be invited at the discretion of the Owner, Construction Manager, and the Architect. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
2. Review the present and future needs of each entity present, including the following:

a. Interface requirements.
b. Time.
c. Sequences.
d. Status of submittals.
e. Deliveries.
f. Off-site fabrication problems.
g. Access.

h. Site utilization.
i. Temporary facilities and services.
j. Hours of work.
k. Hazards and risks.
l. Housekeeping.
m. Quality and work standards.
n. Change Orders.
o. Documentation of information for payment requests.

D. Reporting: Approximately 5 days after each meeting, CM will prepare and distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1.6 COORDINATION MEETINGS

A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

D. The CM's Field Manager will conduct daily meetings with the prime contractors and major subcontractors' foremen. The purpose of the meetings is to provide the opportunity for each contractor to communicate to the Field Manager any items relating to their respective construction activity for that day (request for shutdown, deliveries, etc.) The meetings will commence from 7:00 o'clock am until 7:30 o'clock am. These meetings are generally informal. The CM's Field Manager will keep minutes of these meetings when appropriate and will be available upon request.

1.7 SAFETY MEETINGS

A. Each Contractor will be responsible to conduct their own safety meetings on a regular basis (but not less than four times during any thirty-day period.)

B. Minutes of the Safety Meeting must be maintained by each contractor onsite and must be made available upon request. Failure to conduct and submit meeting minutes will be grounds to reject the Prime Contractor's progress payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 013150 – COVID-19 CONTRACTOR COMPLIANCE

The contents of this Section are NOT authored by the Owner, Architect of Record, Engineers of Record, nor the Construction Manager, but are provided as guidelines published by others, including but not limited to, the CDC, ESD (Empire State Development), DOH, OSHA, etc.

1.1 In response to the public health emergency for the COVID-19, Governor Andrew Cuomo has declared a State disaster emergency and temporarily suspended or modified laws that would prevent, hinder, or delay action necessary to cope with the disaster or emergency. The Governor has also issued directives to allow for the expansion of certain services including those relating to emergency procurement, and to facilitate the continued work of essential businesses. Under Executive Order 202.6, as amended September 2020, a construction project is permitted to continue if it is essential. Please refer to Empire State Development (ESD) guidance to determine if your project is essential https://esd.ny.gov/guidance-executive-order-2026. The purpose of this guidance is to set forth the recommended practices for all Contractors performing work at construction sites in the context of the COVID-19 health crisis.

A. Contractor Responsibilities:

Under standard contracting agency/authority agreements,

1. Contractors and their subcontractors are always required to guard the safety and health of all persons on and in the vicinity of the work site
2. Contractors and their subcontractors are required to comply with all applicable rules, regulations, codes, and bulletins of the New York State Department of Labor and the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended (“OSHA”)
3. Contractors and their subcontractors are also required to comply with all Client safety requirements
4. Contractors and their subcontractors must comply with all City or State of New York safety requirements for projects within the City or State of New York constructed in accordance with the applicable building code, and contractors are required to provide written safety plans for the site showing how all safety requirements of applicable law will be implemented for the duration of the contract
5. Contractors will comply with these requirements as part of their contract, as well as any updates / revisions which are subsequently issued by the governing agencies.

1.2 Contractors and their subcontractors must also adhere to the following practices to help prevent exposure and spread of COVID-19. The following recommendations are based on what is currently known about COVID-19. Contractors and their subcontractors are advised to stay current and immediately implement the most up-to-date practices to protect the safety and health of your employees, clients, and the general public.

A. Contractor Submittals
   1. All contractors are required to submit a copy of their own company policy which confirms their compliance with these requirements and demonstrates your workers will properly comply.
   2. Designate a specific “Responsible party” who will be the individual on-site in charge of COVID compliance
   3. Include in your submission the name of the designated individual who will be onsite.

B. General Responsibilities:
   1. Contractors and their subcontractors should educate their employees on the symptoms of COVID-19, which include cough, fever, trouble breathing, and pneumonia. Contractors and their subcontractors must instruct any employee who feels they may meet the above criteria to refrain from reporting to the jobsite and immediately contact their local health department in the county in which they reside.
   2. If the employee begins to exhibit these symptoms while in the workplace, steps should be taken to isolate the individual, place a surgical mask on the individual and inform your local health department and the contracting agency/authority.
   3. Personnel should be advised to self-quarantine in accordance with the requirements of the New York State and local health department. Contracting agencies/authorities reserve the right to require any employee of the Contractor, and their subcontractors exhibiting symptoms, to be removed from the jobsite.
   4. If an employee is confirmed to have COVID-19 infection, contractors and their subcontractors should inform fellow employees, who have been in contact with this employee, of their possible exposure to COVID-19 in the workplace while maintaining confidentiality as required by applicable New York State and federal law. The fellow employees should then self-monitor for symptoms (i.e., cough, fever, trouble breathing, and pneumonia) and self-quarantine in accordance with the requirements of the New York State and local health department.
   5. If an employee tests positive for COVID-19, Contractors and their subcontractors should direct the employee to self-quarantine or remain quarantined for 14 days, following the guidance of New York State and local health department.
   6. Contractors and their subcontractors may permit such employee to return to the jobsite when this employee produces a negative COVID-19 test or receives medical clearance to return to work.
   7. If an employee tests negative for COVID-19, contractors and their subcontractors may direct the employee to return to work after recovery from their illness. Any direct contacts on pre-cautionary quarantine may return to the jobsite and resume their work activities.

C. Social Distancing:
   1. Do not host large group meetings or congregate in large groups. When meetings are necessary, maintain a distance of 6 feet between people

2. Perform any toolbox or other training maintaining the distance of 6 feet between people
3. Perform meetings online or via conference call whenever possible
4. Only essential personnel should be permitted on the jobsite
5. Discourage handshaking and other contact greetings

D. General Jobsite Practices:

1. Procedures and supplies should be in place to encourage proper hand and respiratory hygiene. **General Work Contractor is required to provide, install and maintain self -contained temporary hygiene/washing station(s) for use by all site workers – provide minimum 1 washing station per 20 workers**
(Site Contractor will provide these same wash stations for all site workers)
   a. Hand Hygiene:
      Signage with handwashing procedures should be posted in prominent locations promoting hand hygiene:
      1. Regular handwashing with soap and water for at least 20 seconds should be done:
         - Before and after eating.
         - After sneezing, coughing, or nose blowing
         - After using the restroom
         - Before handling food
         - After touching or cleaning surfaces that may be contaminated
         - After using shared equipment and supplies; and also
         - Whenever a contractor or subcontractor believes it is necessary
      2. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol
   b. Respiratory Hygiene:
      1. **ALL SITE PERSONELL MUST WEAR FACE COVERING PROTECTION AT ALL TIMES TO COVER MOUTH AND NOSE (No Exceptions)**
      2. Covering coughs and sneezes with tissues or the corner of elbow
      3. Disposing of soiled tissues immediately after use

2. **At the end of each work shift each Contractor will perform routine environmental cleaning and disinfecting of all hard surfaces in the common and work areas.** This includes corridor surfaces, doorknobs, workstations, project trailers and offices, portable toilets, countertops, handles, gang boxes, tools and equipment. See OSHA Guidance on Preparing Workplaces for COVID-19.
   www.osha.gov/Publications/OSHA3990.pdf
3. Appropriate cleaning agents and directions should be utilized to perform all cleaning. Ensure all workers are trained on the hazards of cleaning chemicals used in the workplace and comply with all OSHA requirements regarding same in accordance with the Hazard Communication (Global Harmonization) Standard. Information about https://coronavirus.health.ny.gov/home
4. Do not use a common water bottle
5. If using a common water cooler clean dispenser knob after use

6. Do not share tools
7. Utilize personal protection equipment (PPE) for the job being performed
8. Sanitize reusable PPE per manufacturer's recommendation prior to each use
9. Do not share PPE
10. Ensure used PPE and other trash is disposed of properly
11. Utilize disposable gloves where appropriate and instruct workers to wash hands after removing gloves
12. Disinfect reusable supplies and equipment
13. Stagger work schedules to minimize the number of people on a job site at any one time
14. Keep one contractor or subcontractor in an area at a time. Indicate an area is occupied with workers with a sign or flag indicating which contractor or subcontractor is in the area at that time. Remove the sign or flag after completion of work in that area to let others know they may then enter into that area to perform their work. The next contractor or subcontractor will then post their sign or flag to notify others that the area is occupied.
15. Minimize the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) scheduling work activities to stagger those required to be in any one time to a minimal number of workers.
16. Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exits.
17. Avoid cleaning techniques, such as pressurized air or water sprays that may result in generation of bioaerosols

1.3 Contracting agencies/authorities may request an updated written safety plan for the site to address practices to help prevent exposure and spread of COVID-19 at the jobsite pursuant to New York State, OSHA recommendations and Centers for Disease Control requirements, which include:

1. Assessment of potential worker exposure hazards, taking into account the specific recommendations and controls for the four levels of worker exposure risk identified in OSHA's Guidance on Preparing Workplaces for COVID-19 (i.e. very high, high, med, Low)
2. Selecting, implementing, and ensuring the use of control (i.e., social distancing appropriate personal protective equipment, hygiene, and cleaning supplies);
3. Minimizing the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) and scheduling work activities to stagger those required to be in any one area to a minimal number of workers.
4. Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exists; and
5. Additional criteria consistent with health and safety practices at the work site

1.4 Project Closure:

1. Where work is suspended on a project, contractors are directed to follow any additional project shut-down protocols as provided by the contracting agency/authority

2. For NYS Business Reopening Safety Plan Template and Construction Master Guidance Plan please refer to below links:

   https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/NYS_BusinessReopeningSafetyPlanTemplate.pdf

   https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/ConstructionMasterGuidance.pdf

E. For additional resources:

OSHA COVID-19 Resources

OSHA Guidance on Preparing Workplaces for COVID-19

DOL COVID-19 Resources

Interim Guidance for Business and Employers

Centers for Disease Control - - https://www.cdc.gov/coronavirus/2019-ncov/index.html

The Bidder agrees it is responsible for complying with any and all health and safety requirements issued by federal, state or local entities, including but not limited to New York State Governor Office Executive Orders, New York State Department of Health rules, regulations and guidance, and other New York State, Fund or Campus laws, rules, regulations or requirements that exist or may be issued and/or amended during the bidding and/or performance of work on this Project.

With respect to the COVID-19 pandemic, Bidder specifically acknowledges and agrees that the NYS DOH Interim COVID-19 Guidance for Construction Projects, "Guidance", in effect at the time of bid is made a part of the contract work for this Project, as set forth in General Requirements. Bidder affirms that all costs and time associated with compliance with the current Guidance are included in its bid. The current Guidance is available at the following website:

https://forward.ny.gov/industries-reopening-phase#phase-one-construction

Notwithstanding the foregoing, Bidder agrees to comply with the Guidance as it may be amended or superseded in the future.

END OF SECTION 013150

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Each Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the contractor can plan and control his work properly and the Construction Manager/Owner can readily monitor and follow the progress for all portions of the work. The Contractor shall complete the detailed schedule within 10 days after contract award.

B. The schedule shall comply with the various limits imposed by the scope of work any by any contractually intermediate milestone dates and completion dates included in the contract.

C. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All durations shall be the result of definitive manpower and resource planning by the Contractor. The contractor will provide specific manpower loading information / crew size to support the duration proposed. (e.g. – 4-man crew can get 1000 sf / day project has 11000 sf, thus duration was identified as 11 days)

D. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:
   1. Area: Subdivision of the site into logical modules or blocks and levels.
   2. Responsibility: contractor or subcontractor responsible for the work.
   3. Specifications: 33 Division CSI format.
   4. System: Division of the work into building systems for summary purposes.
   5. Milestone: Work associated with completion of interim completion dates or milestones.
   6. Pay Item: Work identified with a pay item on the Schedule of Values.

1.2 REPORTS

A. For initial submittal and each update, the contractor shall prepare the following standard report:
   1. Tabular Schedule Report sorted by Activity code and Early Start.

1.3 GRAPHICS

A. For initial submittal the contractor shall prepare the following graphics:
   1. Pure logic diagram (Precedence Format) of entire data, not time scaled, grouped by Activity code.
   2. Detailed bar chart sorted by Activity Code with Early Start and Early Finish.
   3. Summary bar chart summarizing by Activity Code with Early Start and Early Finish.

B. For each update the contractor shall prepare the following graphic:
   1. Bar Chart showing work activities with Early Start in the next 40 work days sorted by Activity Code and Early Start.
   2. Summary Bar Chart summarizing by Activity Code showing progress with Early Start and Early Finish.

C. For each Change Order involving adjustment in the contract time for performance the contractor shall prepare a pure logic diagram showing the changed work with all predecessor and successor activities (Fragnet).

1.4 SUBMITTALS

A. In no case shall first application for payment be approved prior to submission of acceptable preliminary schedule, detailed submittal schedule, and schedule of values.

B. Monthly updates, required schedules and graphics shall be submitted to the Construction Manager/Owner within five working days following the end of the preceding month. Monthly updates, schedules and graphics shall be submitted in five copies.

C. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted within ten (10) calendar days after the return mailing date. Resubmittals shall be in the same quantities as noted above. Review and response by the Construction Manager/Owner will be given within (10) calendar days after resubmission.

1.5 PAYMENT WITHHELD

A. If the Contractor fails to submit the required schedule information as indicated in this section within the time prescribed or revision thereof within the requested time, the Construction Manager/Owner may withhold approval of Progress Payment Estimates until such time as the Contractor submits the required information.

1.6 UPDATES

A. Updates of the Schedule shall be made every two weeks reflecting actual or reasonably anticipated progress as of the last working day of the month. Monthly updates of the Detailed Schedule will be made each month until all work is substantially complete.

B. The Contractor will meet with the Construction Manager/Owner at the end of the updated period to review information in draft form before preparation of the required schedules and graphics. The Contractor will present data, prepared in advance, for review and approval of the Construction Manager/Owner including:
   1. Actual Start Dates.
   2. Actual Completion Dates.
   3. Activity percent complete and/or Remaining Duration.
   4. Revised logic, changes in activity duration's or resource assignments.

5. Narrative report discussing progress through the update period; changes, delays or other circumstances affecting progress; status of the project with respect to completion schedule; and any efforts by the Contractor to improve progress.

C. The update meeting will establish the values to be submitted for payment and will be directly related to the schedule of values in the application for payment.

D. The Contractor shall prepare a report of the meeting and make all changes, additions or corrections to the data resulting from the review. The contractor shall promptly prepare the monthly submittal following the update meeting.

1.7 CHANGES, DELAYS AND EXTENSIONS OF TIME

A. When changes or delays are experienced, the Contractor shall submit to the Construction Manager/Owner a Time Impact Analysis illustrating the influence of each change or delay on the current Contract scheduled completion date. Each time analysis shall include a Fragnet (network analysis) demonstrating how the Contractor proposed to incorporate the change or delay into the Detailed Schedule. Additionally, the analysis shall demonstrate the time impact based on the date the change was given to the Contractor, the status of construction at that point in time, and the activity duration of all effected activities. The activity duration used in this analysis shall be those included in the latest update of the Detailed Schedule, closest to the time of delay or as adjusted by mutual agreement.

B. Each Time Impact Analysis shall be submitted within ten (10) calendar days after a delay occurs or a notice of change order is given to the Contractor. In cases where the Contractor does not submit a Time Impact Analysis for a specific change or delay with a specified period of time, it shall be mutually agreed that no time extension is required. Final evaluation of each Time Impact Analysis by the Construction Manager/Owner shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written change order approved by the Owner. Upon approval of the Owner, Fragnets illustrating the influence of changes and delays shall be incorporated into the Detailed Schedule by the contractor during the first update after agreement is reached.

C. The time difference between the Early Finish date and the Late Finish Date is defined as "float." The "float" belongs to the Project and may be used by the Construction Manager/Owner to benefit the Project. Changes or delays that influence activities in the network with "float" and do not extend the Critical Path (the network of activities with zero days "float") shall not be justification for an adjustment in Contract time for performance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 33 00 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Submittal schedule.
   3. Daily construction reports.
   4. Shop Drawings.
   5. Product Data.
   6. Samples.
   7. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
   1. Permits.
   2. Applications for Payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of subcontractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section " Payment and Modification Procedures" specifies requirements for submittal of the Schedule of Values.
   2. Division 1 Section " Project Management and Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
   3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
   4. Division 1 Section "Quality Requirements" specifies requirements for submittal of inspection and test reports.
   5. Division 1 Section "Project Closeout Requirements " specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section " Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

      1. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
   3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

      1. Submittals must be transmitted in accordance with the requirements of Section 1.6.
      2. Allow between 10 and 12 business days for initial review of the first round of submittals. See 1.6 for more information. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
      3. If an intermediate submittal is necessary, process the same as the initial submittal.
      4. Allow an additional 10 business days for reprocessing each resubmittal.
      5. No extension of Contract Time will be authorized because of contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
      6. **If the contractor delays on key submittals which can negatively impact the project schedule, the owner and his agent(s) can withhold payments as necessary until the proper submittal paperwork is received.**

B. Submittal Preparation:
   1. Each copy of each submittal will have a "submittal cover sheet" attached identifying all information requested by Architect. (see copy after this section) All SCS must be approved by contractor (see electronic stamp B.5) signed, dated and have all fields completely filled-out. Any submittal received without proper

use of this Cover Sheet will be returned immediately to the contractor. Cover sheet for contractor's use is included at the end of this section.

2. A Submittals Website, an internet (web-based) service shall be used by all contractors to provide an on-line database and repository which shall be used to transmit and track project related documents. The Submittals Website is provided by the Construction Manager. Upon Contract award the successful bidders will be given log on instructions. The intent for using the Submittals Website is to expedite the construction process by reducing paperwork, improving information flow, and decreasing submittal review turnaround time.
3. Project submittals (shop drawing, product data and quality assurance submittals) shall be transmitted by the Contractor in Portable Document Format (PDF) to the Submittals Website, where it will be tracked and stored for retrieval for review. After the submittal is reviewed it is uploaded back to the Submittals Website for action or use by the Contractor and Owners Representatives.
4. The service also tracks and stores documents related to the project such as RFI's (Request for Information), Contacts, Meeting Minutes, Punchlist, and Non-Compliance Notices.
5. For each submittal, the Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents, including verification of manufacturer/product, dimensions and coordination of information with other parts of the work. (contractor sign and date)
6. It is the Contractor's responsibility to provide the submittals in a PDF format. The contractor may use any of the following options:
    a. Subcontractors and suppliers provide paper submittals to the Contractor, who electronically scans and converts them to PDF format.
    b. Contract a Scanning Service, which will allow the Contractor and the Contractor's subcontractors and suppliers to provide paper submittals to the Scanning Service, which electronically scans and converts them to PDF format. It will be the Contractor's responsibility to transmit the scanned submittals to the Submittals Website.
7. Image Quality:
    a. Image resolution: The PDF files shall be created at a minimum resolution of 200 dots per inch utilizing the original document size. The Contractor will be responsible to increase the resolution of the scanned file or images being submitted as required to adequately presenting the information.
    b. Image Color Rendition: When information represented requires color to convey the intent and compliance, provide full color PDF reproduction.

C. Contractor Internet Service and Equipment Requirements:
1. The Contractor will be required to have an Email address and Internet access at Contractor's main office.
2. Unless the Contractor will exclusively be using a Scanning Service to create all PDF documents, the Contractor will be required to own a PDF reviewing, creating and editing software, such as Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF reviewing, creating and editing software for applying electronic stamps and comments.

3. The Contractor will be required to have a web browser such as Internet Explorer 11, Firefox 30-51.
4. The Contractor will be required to have Java Run Time Environment: Minimum Java version 8 update 121.
5. The Contractor will be required to have Adobe Reader version 11: Sage uses a pdf creator to generate forms. In order to print / view forms you will need Adobe Reader.
6. Contractors are required to have network securities in place such as anti-virus that is active and up to date. Do not access Contract Management from unsecured or public network location such as free WI-FI hotspots.

D. Training and Support:
   1. A training manual shall be available, free of charge from the Construction Manager, for all project participants regarding use of the Submittals Website and PDF submittals.
   2. Training will be provided by the Construction Manager at Arris's main office located in Poughkeepsie NY. The appropriate personnel from each contractor office are required to attend this meeting.

E. Paper Copies:
   1. Contractor Copies: The Contractor will be responsible for making copies, for the Contractors own use and for use by its subcontractors and suppliers.

F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the CM electronically using a transmittal form. The CM will then transmit to the Architect. The Architect will not accept submittals received from sources other than the Construction Manager.
   1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
   2. Transmittal Form: Use AIA Document G810 and submit Sage notification to ACCI that the submittal has been uploaded. The contractor's transmittal must have the subject description properly filled out, so that all parties can see what section/product is being submitted without having to open the actual submittal.
   3. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Distribution: It is the contractor's responsibility to coordinate submittals with each subcontracting trade. Each contractor shall be required to provide their subcontractors with a complete list of their submittals in order that other contractors can request required submittal information.
   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

1.6 SUBMITTAL SCHEDULE

A. Submittals must be prepared and transmitted as follows, unless otherwise approved by the Construction Manager:
   1. Within 15 working days after Notice to Proceed:
      1. Sediment & Erosion Control Plan & Product Submittals
      2. Precast concrete structures for site
      3. HVAC units
      4. Structural Steel and Hambro System
      5. Precast Plank Shop Drawings
      6. Window Shop drawings
      7. Door & Hardware submission
      8. Ductwork shop drawings
      9. Electrical fixtures and panels
      10. All other submittals critical to the schedule.
   2. Balance of Submittals – within 45 days after Notice to Proceed.
   3. If the contractor misses the milestone submittal timeframes listed above, the owner / agents can withhold requisition payments until the required paperwork is received. **If there are any open submittals beyond 60 days of contract award, the owner will stop all contractor payments until all missing paperwork is received.**
   4. Upon approval by the Construction Manager, non-critical submittals may be transmitted later.
   5. Prepare submittals including information in paragraph 1.4B above.

B. Schedule Updating: Revise the submittal schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and electronically submit one copy to the Construction Manager by 10:00 am the following day. Any contractor not submitting required reports will not receive approval on the subsequent application for payment until such time that all required information is submitted:
   1. List of subcontractors at the site.
   2. Count of personnel at the site (substantiates payroll).
   3. High and low temperatures, general weather conditions.
   4. Accidents and unusual events.
   5. Meetings and significant decisions.
   6. Stoppages, delays, shortages, and losses.
   7. Meter readings and similar recordings.
   8. Emergency procedures.
   9. Orders and requests of governing authorities.
   10. Change Orders received, implemented.
   11. Services connected, disconnected.
   12. Equipment or system tests and startups.
   13. Partial Completions, occupancies.
   14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included by sheet and detail number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
   7. All Technical Submittals:

      1. Electronic shop drawing submittal to Construction Manager.
   8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
   9. Maintain approved copies on site to record “as-built” conditions.
   10. Submit additional copies of as-built, approved drawings as specified in project closeout.

1.9 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Submit prior to shop drawings or simultaneously when products are specified items or A/E approval is granted. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following that are not required, mark copies to indicate the applicable information. Include the following information:

      1. Manufacturer's printed recommendations.
      2. Compliance with trade association standards.
      3. Compliance with recognized testing agency standards.
      4. Application of testing agency labels and seals.
      5. Notation of dimensions verified by field measurement.
      6. Notation of coordination requirements.
   2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
   3. Submit digitally through the Submittals Website to CM.
   4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

1. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Sample are submitted directly to the architect's home office and copy Construction Manager with transmittal.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:

    1. Specification Section number and reference.
    2. Generic description of the Sample.
    3. Sample source.
    4. Product name or name of the manufacturer.
    5. Compliance with recognized standards.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

    1. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    2. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    3. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
    4. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Preliminary Submittals: Submit a full set of choices where Samples are required for selection of color, pattern, texture, or similar characteristics from a range of standard and premium choices.

    1. The Architect will review and distribute selections made or other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 6 sets to the Architect who will distribute one set to CM and two (2) to the contractor marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

1. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
2. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

1. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.12 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
1. Compliance with specified characteristics is the Contractor's responsibility, as stated on the approval stamp.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
1. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.
2. Final Unrestricted Release: When the Architect marks a submittal "Furnish as Corrected", the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
3. Final-But-Restricted Release: When the Architect marks a submittal "Make Corrections Noted", the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the

Contract Documents. Final payment depends on that compliance. (No resubmittal is required.)

4. “Revise and Resubmit” When the Architect marks a submittal " Revise and Resubmit”, do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay.
5. Returned for Resubmittal: When the Architect marks a submittal "Rejected”, do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary, to obtain different action mark.

   I. Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.
6. Other Action: Where a submittal is for information or record purposes only and does require approval and the contractor is responsible for the conformance of the product, the Architect will return the submittal marked "Reviewed".
7. “Submit specified item”: When submittal is marked “Submit Specified Item”, the Contractor shall immediately submit the specified item,

PART 2 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for monitoring the quality of the constructed project.
B. Work of this Section also includes services of an independent testing laboratory for quality assurance testing.

1.2 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:
   1. Division 1 Section “Testing Laboratory Services” specifies requirements for coordination and notification of any owner-tested items.
   2. Division 1 Section “Submittals” specifies requirements for development of a schedule of required tests and inspections.
   3. Division 1 Section “Special Inspections & Structural Testing”

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Each Prime Contractor shall continually monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or workmanship that is more precise.
C. Perform work by persons qualified and skilled to produce workmanship of specified quality.
D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
F. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision.
   1. **Contractor Responsibilities:**
      a. Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum unless specifically identified as provided by others.
      b. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor’s responsibility, the Contractor shall employ and pay a qualified independent testing agency to

perform quality-control services. Costs for these services are included in the Contract Sum.

c. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

d. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will engage the services of a qualified independent testing agency to perform those services. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders.

1.4 MOCK-UP

A. Tests will be performed under provisions identified in this Section and identified in the respective product specification sections.
B. Assemble and erect specified mock -ups with specified attachment and anchorage devices, flashing, seals, and finishes.
C. Accepted mock-ups shall be a comparison standard for the remaining work.
D. Where a mock-up has been accepted by the Engineer/Architect and is specified to be removed, then the Contractor shall remove the mock-up and the clear area when directed to do so by the Engineer/Architect.

1.5 QUALITY ASSURANCE - TESTING LABORATORY

A. In order to establish compliance with the Contract Documents, materials shall be tested, examined and evaluated before they are incorporated into the work. During and after installations, additional tests, examinations, and evaluations shall be made to determine continued compliance throughout the course of the work.
B. Testing laboratory shall be a reputable, experienced firm that is capable of performing all of the required testing and authorized to operate in the state in which the project is located.
C. Perform all sampling and testing in accordance with specified procedures and use the materials, instruments, apparatus, and equipment required by the codes, regulations and standards. Where specific testing requirements or procedures are not described, perform the testing in accordance with all pertinent codes and regulations and with recognized standards for testing.
D. In the event that samples and test specimens are not properly taken, handled, stored or delivered or if other requirements of this Section are not complied with, Engineer/Architect reserves the right to delegate any or all of this work to others, or to take whatever action deemed necessary to ensure that sampling and testing are properly accomplished, for which all costs shall be borne by Contractor.
E. Construction Manager/Architect reserves the right to disapprove the use of a specific testing laboratory, even after prior approval, if the laboratory fails to meet or comply with the requirements of this Section. If this should occur, immediately discharge the testing

laboratory and retain the services of a different laboratory acceptable to Engineer/Architect.

F. The testing laboratory shall meet the following criteria:
   1. Be capable of performing all of the required tests.
   2. Be regularly engaged in performing the types of services required.
   3. Have adequate facilities, materials, equipment, and personnel to perform the services.
   4. Have an adequately trained, experienced and qualified staff.
   5. Have at least one registered professional engineer licensed in the state in which the project is located who shall be capable of performing field tests, supervising laboratory testing and interpreting test results. The professional engineer shall be thoroughly knowledgeable in materials, soils, asphalt paving and concrete.
   6. Shall be able to be on the Project site within two hours after being notified.
   7. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.6 REFERENCE STANDARDS

A. Conform to reference standards by date that the project was last bid.
B. Obtain copies of standards when required by Contract Documents.
C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer/Architect before proceeding.
D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.7 SUBMITTALS

A. Within fifteen (15) calendar days from the date of the Notice to Proceed, submit documentation from three (3) testing laboratories that clearly indicates experience, location, qualifications of staff, and descriptions of any limitations or restrictions of the firm.
B. Certified copies of each test report shall be mailed directly to the Engineer/Architect. The Contractor shall arrange with the laboratory to secure copies.
C. Each report shall be in writing and shall include the testing method used, the test results, the specified results, the exact location of where the test specimens were taken, the date taken, Project identification, Contractor's name and other pertinent information required for a complete and meaningful test report.
D. Each report shall be signed and certified by a responsible officer of the testing laboratory.
E. Mail reports directly to Engineer/Architect within 24 hours after the sample is taken, except in those instances when tests cannot be immediately performed because of required curing, incubation periods, or lengthy testing procedures.

F. The laboratory shall verbally communicate test results when requested by the Engineer/Architect. This does not eliminate nor replace the requirements for a written report.

1.8 SCHEDULING - LABORATORY SERVICES

A. Except where otherwise specified, the Architect / Construction Manager will determine the number of samples to be taken, the date and time samples will be taken and tests made, the number and type of tests to be performed, who will collect the samples, how they will be handled and stored and when laboratory personnel are required on site.
B. Architect / Construction Manager will notify Contractor of his decision to take samples and/or have tests made and provide him with the pertinent information. Contractor is responsible for notifying the testing laboratory and for having the testing performed, on schedule.
C. In addition to the above, Contractor shall make his own arrangements for the sampling and testing of materials he proposes to incorporate into the work. This shall not be paid for out of the cash allowance.
D. Notify Architect / Construction Manager at least 48 hours in advance of the times at which scheduled samples or tests will be conducted.
E. If samples and/or tests cannot be taken or performed when required, delay the work until such time that they can be accomplished. Where possible, any work that has been installed but has not been sampled or tested as required, shall be tested by other means. Upon r Architect / Construction Manager request, uncover any work, which has been buried or covered, and perform special tests designated. If the work cannot be tested by other means, Architect / Construction Manager may declare the work unacceptable. All costs associated with noncompliance and for special testing shall be borne by the Contractor and not be paid for out of the cash allowance.
F. Should the testing laboratory be scheduled to take or collect samples or to perform tests, and finds that it is unable to do so as a result of delays in construction, inclement weather, or any other reason, reschedule the tasks for a date acceptable to Architect / Construction Manager. Costs associated with times testing laboratory is unable to perform scheduled services shall be borne by the Contractor and will not be paid for under the allowance.
G. Plan all work and operations to allow for the taking and collection of samples and allow adequate time for the performance of tests. Delay the progress of questionable work until the receipt of the certified test reports.

1.9 TESTING REQUIREMENTS

A. Dry Paint Thickness Measurement: Perform dry paint thickness using calibrated SSPC Type 2 fixed probe gages.

1.10 TESTING SCHEDULE

A. Dry Paint Thickness Measurement:

1. Make five (5) separate spot measurements spaced evenly over 100 square feet of area.
2. For structures exceeding 1000 square feet of finished surface, three 100 square feet areas shall be randomly selected by the Engineer/Architect plus one 100 square foot area for each additional 1000 square feet of finished surface. This requirement shall be subject to change as required by the Engineer/Architect.

1.11 FIELD OBSERVATION OF CONTRACTOR'S WORK

A. The Architect / Construction Manager will provide periodic observation of the Contractor's work in accordance with the General Conditions of the Contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions. Verify that the existing substrate is capable of structural support or attachment of new Work being applied or attached. Examine and verify specific conditions described in individual specification sections. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance. Seal cracks or openings of substrate prior to applying next material or substance.
B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 FIELD QUALITY CONTROL

A. Allow representatives of the testing laboratory access to the work at all time. Provide all equipment, labor, materials, and facilities required by the laboratory to properly perform its functions. Cooperate with and assist laboratory personnel during the performance of their work.
B. Test specimens and samples shall be taken by the person(s) designated in other Sections, or as directed by Architect / Construction Manager. Conduct field sampling and testing in the presence of Architect / Construction Manager. Provide all materials, equipment, facilities and labor for securing samples and test specimens and for performing all field-testing.

END OF SECTION

SECTION 01 45 29 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. From time to time during the progress of the Work, the Construction Manager or Owner may require that testing be performed to determine that the Work complies with the specified requirements.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 01 33 00 - Submittals specifies requirements for development of a schedule of required tests and inspections.
2. Section 01 45 00 – Quality Requirements specifies the administrative and procedural requirements for quality control services.
3. Section 01 45 33 – Special Inspections & Structural Procedures identifies the areas which must be tested.

PART 2 - PRODUCTS

2.1 TESTING LABORATORY

A. The New York State Certified testing laboratory will be selected by the Owner.

PART 3 - EXECUTION

3.1 PAYMENT FOR TESTING SERVICES

A. Except where specifically indicated as being the Contractor's responsibility, tests and inspections required by the Owner, Construction Manager and/or Architect will be paid for by the Owner.

B. Retesting: When initial tests indicate non-compliance with Contract Documents, the responsible Prime Contractor is required to pay for all subsequent re-testing until compliance is accomplished.

C. Contractor's Convenience Testing: Testing requested by the contractor for his information or convenience shall be paid for by Contractor.

D. Code Compliance Testing Where indicated in the Documents, tests required by Building Code or Ordinances or by an approval authority shall be paid for by the Owner.

3.2 COOPERATION WITH TESTING LABORATORY

A. Access:

1. Provide representatives of the testing laboratory access to the work at all times.
2. Provide facilities for such access in order that the laboratory may properly perform its function.

B. Schedule and Notification:

1. **When tests are required by the Contract Documents or by the Construction Manager, Architect or Owner, notify within 48 hours pror to expected time for operations requiring testing services.**
2. If, after such notification, the testing laboratory is prevented from performing its work due to imcompletemess of the project work, all extra costs for testing attributable to the delay shall be paid by the Contractor.

3.3 SPECIMENS

A. All sampling equipment and personnel shall be provided by the testing laboratory.

B. All deliveries of specimens and samples to the testing laboratory shall be performed by the testing laboratory.

END OF SECTION 01 45 29

SECTION 01 45 33 – SPECIAL INSPECTIONS AND STRUCTURAL TESTING

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Special Inspection and Testing shall be in accordance with Chapter 17 of the 2020 Uniform Code of New York State (UCNYS).

B. The program of Special Inspection and Testing is a quality assurance program intended to ensure that the work is performed in accordance with the Contract Documents.

C. This specification section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This specification section is also intended to notify the Approved Special Inspection Agency, hereinafter referred to as the Special Inspector (SI), and other Agents of the Special Inspector, of their requirements and responsibilities.

D. The Special Inspector shall be the individual in charge of the Special Inspection and Testing program. The SI shall supervise and review the work of the Inspection and Testing Agents for each inspection or test. As explained in UCNYS Section 1704.2.1, the SI, and all its Agents, shall demonstrate competence to the satisfaction of the Registered Design Professional in Responsible Charge (RDPIRC) and the Building Official (BO) for inspection or testing of the particular type of construction or operation requiring special inspection or testing. Unless otherwise noted or agreed upon by the RDPIRC and the BO, the minimum qualifications are listed in the Statement of Special Inspections (attached):

E. Frequency of Special Inspection or Testing: The individual special inspections and tests shall be performed either continuously or on a periodic basis, as defined below, in accordance with the Statement of Special Inspection and Testing:

I. Inspection, Continuous: The full-time observation of work requiring special inspection by an approved Special Inspector, or Agent, who is continuously present in the work area where the work is being performed.

II. Inspection, Periodic: The intermittent observation of work requiring special inspection by an approved Special Inspector, or Agent, who is present in the work area where the work has been or is being performed, and at the completion of the work.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division I Specification Sections, apply to this Section.

B. Code Required Special Inspections and Procedure (attached).

I. The Special Inspections and Procedure was prepared by the Structural Engineer of Record (SER) Conlon Engineering, LLC – the RDPIRC for the structural work scope of this project and the Architect of Record, Sullivan Architecture, P.C.

1.3 PAYMENT

A. The Owner shall engage and pay for the services of the Special Inspector and all Agents of the Special Inspector.

B. The Contractor shall be responsible for the cost of any retesting or reinspection of work which fails to comply with the requirements of the Contract Documents, and any costs related to correcting the deficient work.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. The Statement of Special Inspection and Testing shall be submitted to the BO with the application for Building Permit.

B. The Contractor shall cooperate with the Special Inspector, and its Agents, so the special inspections and testing can be performed without hindrance.

C. The Contractor shall provide adequate OSHA-compliant access for the Special Inspector and its Agents to perform their work. This includes access to pipe scaffolds, swing-stage scaffolds, and any other method of accessing the work areas that the Contractor or its agents use to perform the work of the Contract.

D. The Contractor shall review the Statement of Special Inspection and Testing and shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Construction Manager who will schedule the Special Inspector (or Inspection and Testing Agents) at least 48 hours in advance of a required test or inspection. Uninspected work requiring inspection may be rejected solely on that basis.

E. The Contractor shall provide incidental labor and facilities to:

I. Provide access to the work to be inspected or tested.
II. Obtain and handle samples at the site or at the source of products to be tested.

III. Facilitate tests and inspections.
IV. Store and cure test samples.

F. The Contractor shall keep at the project site, the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the Special Inspector and its Agents.

G. The Special Inspection and Testing program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program. All work subjected to special inspection and testing shall first be reviewed by the Contractor's Quality Control personnel.

H. The Contractor shall acknowledge each item listed as a discrepancy by the Special Inspection and Testing program in writing to the RDPIRC and Owner. The acknowledgement shall identify whether or not the discrepancy has been corrected, is in compliance with the contract documents, and is ready for re-inspection.

I. The Contractor shall ensure all products, materials or assemblies are properly labeled so the Special Inspector or its Agents can easily observe the label to confirm compliance with the approved construction documents.

J. The Contractor shall be solely responsible for construction site safety.

1.5 LIMITS ON SPECIAL INSPECTOR AND TESTING AGENT AUTHORITY

A. Neither the Special Inspector nor its Agents may release, revoke, alter, or expand on the requirements of the Contract Documents.

B. The Special Inspector and its Agents will not have control over the Contractor's means and methods of construction.

C. Neither the Special Inspector nor its Agents shall be responsible for construction site safety.

D. Neither the Special Inspector nor its Agents shall have authority to stop the work.

1.6 RESPONSIBILITIES OF SPECIAL INSPECTOR AND INSPECTION AND TESTING AGENTS

A. The Special Inspector shall submit to the RDPIRC and BO for review and approval a copy of their qualifications and qualifications of all Agents, which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. The Special Inspector, and all Agents, shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

C. The Special Inspector and its Agents shall have adequate equipment to perform the required tasks. The equipment shall be periodically calibrated in accordance with equipment manufacturers' recommendations.

D. The Special Inspector and its Agents shall notify the Contractor of their presence on the job site at the start of any required inspection or test.

E. The Special Inspector and its Agents shall notify the Contractor of the results of any inspection or test upon completion of the inspection or testing task, including any discrepancies noted. The Special Inspector shall report any discrepancies from the Contract Documents found during an inspection. If the discrepancies are not corrected during the inspection, the Special Inspector shall notify the RDPIRC and BO prior to the completion of that phase of work. Reports shall document all discrepancies identified and the corrective action taken.

F. The Special Inspector and its Agents shall prepare detailed reports of each inspection or test and submit the reports within three days of the inspection or test. Reports shall be in electronic format (legible handwritten reports may be submitted if final typed copies are not available) and include:

I. Date of test or inspection.
II. Name of inspector or technician and name of inspection or testing firm representing.
III. Location of specific areas tested or inspected.
IV. Description of test or inspection and results.
V. Identification of discrepancies.
VI. Indication that contractor was made aware of discrepancies.
VII. Whether or not the discrepancies were corrected.
VIII. Applicable ASTM standard.
IX. Weather conditions (temperature, wind speed, humidity, cloud cover, etc.).
X. Signature of inspector, or of the individual overseeing the inspection of testing.

G. Inspection and testing reports shall be submitted to the RDPIRC and BO, or as agreed upon at the Special Inspection and Testing pre-construction meeting.

H. A Special Inspection and Testing pre-construction meeting shall be held by the Special Inspector. The meeting shall include any Inspection and Testing Agents, the Contractor, any applicable subcontractors and RDPIRC. The purpose of the meeting shall be to identify the specifics of the Special Inspection and Testing program, including, but not limited to, the following:

I. Identify the Special Inspector and Testing Agents.
II. Review this specification section and Statement of Special Inspection and Testing.
III. Determine the distribution list for inspection and testing reports.
IV. Provide contact information.
V. Determine which party shall schedule inspections and testing.

I. The Special Inspector and its Agents shall notify the RDPIRC by telephone or email of any test results which fail to comply with the requirements of the Contract Documents.

J. At the completion of the work requiring special inspections or testing, each Inspection and Testing Agent, shall provide a statement to the Special Inspector that all work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed.

1.7 FINAL REPORT OF SPECIAL INSPECTION AND TESTING

A. The Final Report of Special Inspection and Testing shall be completed by the Special Inspector and submitted to the RDPIRC and BO prior to the issuance of a Certificate of Use and Occupancy.

B. The Final Report of Special Inspections and Testing will document that all required inspections have been performed and that all discrepancies have been resolved. Any unresolved discrepancies shall be clearly noted.

1.8 SUBMITTALS BY OWNER TO THE BUILDING OFFICIAL

A. In addition to the submittal of the special inspection and testing reports in accordance with UCNYS Section 1704.2, reports and certificates shall be submitted by the Owner, or Owner's Authorized Agent, to the Building Official for each of the following:

I. Certificates of Compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of a registered and approved fabricator in accordance with UCNYS Section 1704.2.5.1.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – STATEMENT OF SPECIAL INSPECTIONS

Project:	Bedford Fire Headquarters
Location:	550 Old Post Road, Bedford, NY 10506
Owner:	Bedford Village Fire District
Owner's Address:	34 Village Green, Bedford, NY 10506
Design Professional in Responsible Charge:	Conlon Engineering, LLC 246 Federal Rd, B23 Brookfield, CT 06804
Architect of Record:	Sullivan Architecture, P.C.

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This Statement of Special Inspections encompass the following disciplines:

☒ Structural ☐ Mechanical/Electrical/Plumbing

☐ Architectural ☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A Final Report of Special Inspections documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: Monthly or ☐ per attached schedule.

Prepared by:

Patrick J. Conlon, PE
(type or print name)

Patrick J. Conlon 6/8/2020
Signature Date

Design Professional Seal

Owner's Authorization:

Owner to return signed copy to Conlon Engineering

Signature Date

Building Official's Acceptance:

Signature Date

Schedule of Inspection and Testing Agencies

Statement of Special Inspections includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☒ Precast Concrete
- ☐ Shotcrete
- ☐ Masonry Level B
- ☒ Masonry Level C
- ☒ Structural Steel
- ☒ Cold-Formed Steel Framing
- ☒ Prefabricated Cold-Formed Trusses
- ☐ Prefabricated Wall Panels
- ☐ Spray Fire Resistant Material
- ☐ Wood Construction
- ☐ Prefabricated Wood Trusses
- ☐ Exterior Insulation and Finish System
- ☐ Mechanical & Electrical Systems
- ☐ Architectural Systems
- ☐ Special Cases

Special Inspection Agencies	**Firm**	**Address, Telephone**
1. Special Inspector	Conlon Engineering	246 Federal Rd Suite B23 Brookfield, CT 06804 (203) 740-0990
2 Testing Laboratory - pre-approved list. See notes below.	Test-Con, Inc.	16 East Franklin Street PO Box 3116 Danbury, CT 06813-3116 203-748-3012
	Advance Testing	3348 Route 208

		Campbell Hall, NY 845-496-1600
	Tri State Materials Testing Lab	60 Woodlawn Rd Berlin, CT 06037 203-949-7733
	Special Testing Laboratory	P. O. Box 200 Bethel, CT 06801 203-743-7281
3 Geotechnical Engineer	Carlin Simpson & Associates	984 Southford Road Sayreville, NJ 08872 732-432-5717

Notes:

The inspection and testing agent shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

In accordance with the provisions of Chapter 541, Section 29-276b of the New York General Statutes, the inspection and testing agent shall be accredited by the National Voluntary Laboratory Accreditation Program (NAVLAP) of the National Institute of Standards and Technology and shall have a professional engineer, licensed in the State of New York, certify their inspection and testing reports with his seal and signature.

Seismic Design Category:	D
Ultimate Wind Speed (3 Second Gust)(mph):	129
Wind Exposure Category:	B

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided if requested.

Key for Minimum Qualifications of Inspection Agents:

When the Registered Design Professional in Responsible Charge deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear below the Agency Number on the Schedule.

PE/SE	Structural Engineer – a licensed SE or PE specializing in the design of building structures
PE/GE	Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations.
EIT	Engineer-In-Training – a graduate engineer who has passed the Fundamentals of Engineering examination

American Concrete Institute (ACI) Certification

ACI-CFTT Concrete Field Testing Technician – Grade 1.

ACI-CCI Concrete Construction Inspector

ACI-LTT Laboratory Testing Technician – Grade 1&2.

ACI-STT Strength Testing Technician.

American Welding Society (AWS) Certification

AWS-CWI Certified Welding Inspector.

AWS/AISC-SSI Certified Structural Steel Inspector

American Society of Non-Destructive Testing (ASNT) Certification

ASNT Non-Destructive Testing Technician – Level II or III

International Code Council (ICC) Certification

ICC-SMSI	Structural Masonry Special Inspector
ICC-SWSI	Structural Steel and Welding Special Inspector
ICC-SFSI	Spray-Applied Fireproofing Special Inspector
ICC-PCSI	Prestressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector

National Institute for Certification in Engineering Technologies (NICET)

NICET-CT	Concrete Technician – Levels I, II, III & IV
NICET-ST	Soils Technician - Levels I, II, III & IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III & IV

Exterior Design Institute (EDI) Certification

EDI-EIFS	EIFS Third Party Inspector

Other

SCSI	Smoke Control Special Inspector
PE/ME	Mechanical/Electrical/Plumbing Engineer – a licensed PE specializing in the design of mechanical, electrical and plumbing building systems
RA	Registered Architect specializing in the design of architectural building systems

Soils and Foundations

Item	Agent No. (Qualif.)	Scope
1. Site Preparation	3 (PE or EIT)	**Section 1705.6. Site preparation.** Prior to placement of the prepared fill, determine that the site has been prepared in accordance with the approved soils report, as stated in Section 1803.5. Inspect soils below footings for adequate bearing capacity and consistency with the approved soils report, as stated in Section 1803.5.
2. Controlled Structural Fill	3 (PE or EIT)	**Section 1705.6. During fill placement**. During placement and compaction of the fill material, determine that the material being used and the maximum lift thickness comply with the approved soils report, as stated in Section 1803.5. Verify extent and slope of fill placement.
	3 (PE or EIT)	**Section 1803.5.8. Compacted fill material.** Perform sieve tests and modified Proctor tests of each source of fill material. Through testing, verify that the compacted fill to be used under footings and under slabs complies with the approved soils report, as stated in Section 1803.5.
	3 (PE or EIT)	**Section 1705.6. Evaluation of in-place density**. Review that the in-place dry density of the compacted fill complies with the approved soils report, as stated in Section 1803.5.
3. Other	3 (PE or EIT)	Within the building perimeter, observe placement of underslab and perimeter drainage elements, including crushed stone, perforated pipes, and geocomposite drains.

Cast-in-Place Concrete

Item	Agent No. (Qualif.)	Scope
1. Mix Design	1 (PE or EIT) 2 (ACI)	**Table 1705.3.5.** Review concrete mix design submittals for all classes of concrete specified on the structural drawings. Reference standard ACI 318: Ch.4, 5.2-5.4. IBC Reference Sections 1904, and 1905.2-1905.4. Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design.
2. Material Certification	1 (PE or EIT)	**Section 1705.3.1. Materials.** Review material certificates of compliance or other acceptable documentation for all materials used in the concrete mix designs for conformance with ACI 318 Chapter 3. In the absence of sufficient data or documentation providing evidence of conformance to quality standards of materials in chapter 3 of ACI 318, materials shall be tested in accordance with the appropriate standards and criteria.
3. Reinforcement Installation	1	**Table 1705.3.1.** Review the following percentages of installed reinforcement for compliance with approved shop drawings, project specifications and ACI 318: Ch. 3.5, 7.1-7.7. IBC Reference Sections 1903.5, 1907.1, and 1907.: Footings 50%, Foundation Walls 50%, Retaining Walls 50%, Slabs on Grade 50%, Elevated Slabs 50%, and Topping Slabs 50%.
4. Post-Tensioning Operations	1 (PE or EIT)	Not applicable

5. Anchor Rods	1 & 2 (ACI)	Review 50% of cast-in-place anchors for anchor materials, size, positioning, spacing, edge distance and embedment for compliance with approved shop drawings. Review concrete placement and consolidation around anchors as per "Concrete Placement" section of this Statement. Review 100% of post-installed mechanical anchors and 75% of post-installed adhesive anchors and adhesive dowels for anchor and dowel materials, adhesive materials, size, positioning, spacing, edge distance and embedment for compliance with approved contract documents. Review drilled holes (for proper preparation, size, depth and cleaning), and anchor and dowel installation for compliance with manufacturer's requirements. Proof test 5% of post-installed anchors as per manufacturer's recommendations. For all of the above, initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
	1 & 2 (ACI)	Table 1705.3. Review 100% of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased. IBC Reference Section 1912.5. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.

6. Concrete Placement	2 (ACI)	**Table 1705.3.7.** Continuous inspection of concrete placement for proper application techniques as specified in ACI 318: 5.9 and 5.10. IBC Reference Sections 1905.9, and 1905.10. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
7. Sampling and Testing of Concrete	2 (ACI)	**Table 1705.3.6.** Make one strength test for each 50 cubic yards or fractions thereof from each mix design of concrete placed in any one day. (ASTM C 172, ASTM C 31, ASTM C39). Also, test each specimen for slump (ASTM C143), air content (ASTM C231 or C173), and temperature (ASTM C1064). ACI Reference ACI 318: Ch. 5.6 and 5.8. IBC Reference Section 1905.6.
8. Curing and Protection	1 & 2 (ACI)	**Table 1705.3.8.** Review periodically for maintenance of specified curing temperature and protection techniques, in accordance with ACI 318: 5.11-5.13. IBC Sections 1905.11, and 1905.13. Further, when hot weather concrete conditions exist, verify that the procedure outlined in ACI 305R for Hot Weather Concreting is followed. These conditions will exist when the rate of evaporation approaches 0.21 lb./ft.^{2}/hr. For Cold Weather Concreting, follow ACI 306.1 standard spec. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
9. Other		

Precast Concrete

Item	Agent No. (Qualif.)	Scope
1 Fabricator/Plant Certification / Quality Control Procedures ☐ Fabricator Exempt	1 (PE or EIT) 1 (PE or EIT) 1	**Section 1704.2.5.2.** Verify whether Fabricator holds a current PCI certification If so, special inspections as required by Section 1704.2.1 shall not be required. If not, perform the following: Prior to fabrication, verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control and workmanship and the fabricator's ability to conform to the approved construction documents and referenced standards. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work. At the completion of fabrication, the approved fabricator shall submit a certificate of compliance to the code official stating that the work was performed in accordance with the approved construction documents.
2. Mix Design	1 (PE or EIT)	**Table 1705.3.5.** Review concrete mix design submittals for all classes of concrete specified on the structural drawings. Reference standard ACI 318: Ch.4, 5.2-5.4. IBC Reference Sections 1904, and 1905.2-1905. Review concrete batch operations and verify compliance with approved mix design.
3. Material Certification	1 (PE or EIT	**Section 1705.3.1. Materials.** Review material certificates of compliance or other acceptable documentation for all materials used in the concrete mix designs for conformance with ACI 318 Chapter 3. In the absence of sufficient data or documentation providing evidence of conformance to quality standards of materials in chapter 3 of ACI 318, materials shall be tested in accordance with the appropriate standards and criteria.

4. Reinforcement Installation	1 & 2 (ACI)	**Table 1705.3.1.** Periodically review the installed reinforcement for compliance with approved shop drawings, project specifications and ACI 318: Ch. 3.5, 7.1-7.7. IBC Reference Sections 1903.5, 1907.1, and 1907. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
5. Prestress Operations	1 (PE or EIT)	**Table 1705.3.9.** Inspection of pre-stressed concrete: Continuous inspection of application of pre-stressing forces. Continuous inspection of grouting of bonded pre-stressing tendons in the seismic-force-resisting system. Referenced Standard ACI 318: 18.20 and 18.18.4.
6. Connections / Embedded Items	1 & 2 (ACI)	Review 50% of cast-in-place anchors, connectors and embedded items for their material, size, positioning, spacing, edge distance and embedment for compliance with approved shop drawings. Review concrete placement and consolidation around anchors, connectors and embedded items as per “Concrete Placement” section of this Statement. Review 75% of post-installed mechanical and adhesive anchors and adhesive dowels for anchor and dowel materials, adhesive materials, size, positioning, spacing, edge distance and embedment for compliance with approved contract documents. Review drilled holes (for proper preparation, size, depth and cleaning), and anchor and dowel installation for compliance with manufacturer’s requirements. Proof test 5% of post-installed anchors as per manufacturer’s recommendations. For all of the above, initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
	1 &2 (ACI)	Table 1705.3.3. Review 100% of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased. IBC Reference Section 1912.5. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.

7. Concrete Placement	2 (ACI)	**Table 1705.3.7.** Continuous inspection of concrete placement for proper application techniques as specified in ACI 318: 5.9 and 5.10. IBC Reference Sections 1905.9, and 1905.10. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
8. Sampling and Testing of Concrete	2 (ACI)	**Table 1705.3.6.** Make one strength test for each 50 cubic yards or fractions thereof from each mix design of concrete placed in any one day. (ASTM C 172, ASTM C 31, ASTM C39). Also, test each specimen for slump (ASTM C143), air content (ASTM C231 or C173), and temperature (ASTM C1064). ACI Reference ACI 318: Ch. 5.6 and 5.8. IBC Reference Section 1905.6.
9. Curing and Protection	1 & 2 (ACI)	**Table 1705.3.8.** Review periodically for maintenance of specified curing temperature and protection technique, in accordance with ACI 318: 5.11-5.13. IBC Reference Sections 1905.11, and 1905.13. Further, when hot weather concrete conditions exist, verify that the procedure outlined in ACI 305R for Hot Weather Concreting is followed. These conditions will exist when the rate of evaporation approaches 0.21 lb./ft.^{2}/hr. For Cold Weather Concreting, follow ACI 306.1 standard spec For Cold Weather Concreting, follow ACI 306.1 standard spec. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
10. Erected Precast Elements	1 2 (ACI)	**Table 1705.3.10.** Inspect erected precast concrete frame for member configuration and details to verify compliance with approved shop drawings. ACI Reference ACI 318: Ch.16. Inspect erected precast concrete frame connections, welding and grouting to verify compliance with approved shop drawings. ACI Reference ACI 318: Ch.16.

Masonry – Level C Quality Assurance for Risk Category IV Structures

Item	Agent No. (Qualif.)	Scope Level C Quality Assurance, as defined in Section 3.1.3 of ACI 530-13 for Risk Category IV Structures, shall apply to this project
1. Material Certification	1 (PE or EIT)	**Section 1705.4 Masonry construction.** Review all material submittals for each type of structural masonry unit, mortar, grout, reinforcement and admixtures specified for conformance with the Specification for Masonry Structures (ACI 530.1-13) Article 1.5. Verify installed materials conform to approved samples on site.
2. Mixing of Mortar and Grout	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of mortar and grout proportioning, mixing and consistency to establish conformance with the Specification for Masonry Structures (ACI 530.1) Article 2.1, 2.6 A, 2.6 B, 2.6 C, 2.4 G.1.b and the construction documents. Mortar and grout shall be mixed using a measuring box for accurate proportioning. See Item 5 for the required review percentages. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
3. Anchors	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of g**rade, type, and size of reinforcement and anchor bolts** to establish conformance with the Building Code Requirements for Masonry Structures (ACI 530-13) Section 6.1, the Specification for Masonry Structures (ACI 530.1-13) Article2.4 and 3.4 and the construction documents. Initial review by Special
4. Installation of Masonry	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of masonry unit and mortar installation to establish conformance with the Specification for Masonry Structures (ACI 530.1-13) Article 3.3B and the construction documents. See Item 5 for the required review percentages. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.

5. Mortar Joints	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of the construction of mortar joints, including tooling and filling of joints, to establish conformance with the Specification for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02) Section 3.3B and the construction documents. Verify that the maximum bed joint is 5/8". See Item 5 for the required review percentages. Initial review by Special Inspector with Testing Lab present, followed by reviews by Testing Lab.
6. Reinforcement Installation	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct continuous field reviews of reinforcement installation to establish conformance with Building Code Requirements for Masonry Structures (ACI 530-13) Section 6.1 and the Specification for Masonry Structures (ACI 530.1-13) Article 3.2E, 3.4, 3.6A and the construction documents: shear walls, bearing walls, elevator walls, and exterior walls. Initial review by Special Inspector with Testing Lab present, followed by continuous reviews by Testing Lab.
7. Grouting Operations	1 & 2 (ICC)	**Section 1705.4 Masonry construction.** Conduct continuous field reviews of all grouting for conformance with the Specification for Masonry Structures (ACI 530.1-13) Art. 3.2 D, 3.2 F and the construction documents. Verify that grout space is clean and inspect clean-outs for high-lift grouting. Initial review by Special Inspector with Testing Lab present, followed by continuous reviews by Testing Lab.
8. Size and location of structural elements	2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of masonry structural elements to establish conformance of dimensions and tolerances with the Specification for Masonry Structures (ACI 530.1-13) Article 3.3F and the construction documents.
9. Type, size, and location of anchors including other details of anchorage of masonry to structural members, frames, or other construction	2 (ICC)	**Section 1705.4 Masonry construction.** Conduct continuous field reviews of all anchors, including other details of anchorage of masonry to structural members, to establish conformance with Building Code Requirements for Masonry Structures (ACI 530-13) Sections 6.1.4.3 and 6.2.1 and the construction documents.

10. Welding of reinforcement	2 (ICC)	**Section 1705.4 Masonry construction.** Conduct continuous field reviews to establish conformance with Building Code Requirements for Masonry Structures (ACI 530-13) Sections 8.1.7.7.2, 9.3.3.4 (c), 11.3.3.4(b) and the construction documents.
11. Weather Protection	2 (ICC)	**Section 1705.4 Masonry construction.** Conduct sufficient number of periodic field reviews of completed masonry protection in accordance with the construction documents. Further, when the ambient temperature is below 40° F or above 90° F, review protection for conformance with the Specification for Masonry Structures (ACI 530.1-13) Article 1.8 C, 1.8 D and the construction documents. Verify wall
12. Evaluation of Masonry Strength	2 (ICC)	Units to be tested in accordance with ASTM C140. **Section 1705.4 Masonry construction.** Prism test method not required since the Unit Strength Method for specifying

Structural Steel

Item	Agent No. (Qualif.)	Scope
1. Fabricator Certification / Quality Control Procedures ☐ Fabricator Exempt	1 (PE or EIT) 1 (PE or EIT) &2 (AWS - For Shop Inspection)	**Section 1704.2.5.2.** Verify whether Fabricator holds a current AISC certification for Standard for Steel Buildings Structures (STD). If so, special inspections as required by Section 1704.2.1 shall not be required. If not, perform the following: Prior to fabrication, verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control and workmanship and the fabricator's ability to conform to the approved construction documents and referenced standards. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.
2. Material Certification	2 (AWS) 1 (EIT)	**Table 1705.2.2** Periodic observation of 50% of structural steel, high-strength bolts, nuts, washers and weld filler materials for proper materials identification markings for conformance with ASTM standards specified in the approved contract documents. The inspector shall be present in the area where the work has been or is being performed, and also at the completion of the work. Review structural steel manufacturer's certified mill test reports; high-strength bolts, nuts, washers and weld filler materials for manufacturer's certificate of conformance with ASTM standards specified in the approved contract documents.
3. Open Web Steel Joists	1	Visual inspection of the erected joists and joist girders to verify compliance with the bracing requirements of the Steel Joist Institute. Verify that web stiffeners are in conformance with the approved contract documents.

4. Bolting	2 (AWS)	**Section 1704.3.; Table 1704.3.2.** High-strength, bearing–type connections: Periodic observation of 50% of bolted connections for required size, location and number of bolts and also for contact of plies. The minimum bolt tension, method of tightening and method of inspecting installed bolts shall be as specified in AISC "Specifications for Structural Joints Using ASTM A-325 or A-490 Bolts", and the commentary that follows. Use of a calibrated torque wrench on a previously tightened bolt is not an acceptable method of inspection. High-strength, slip-critical connections, in accordance with the AISC "Specifications for Structural Joints Using ASTM A-325 or A-490 Bolts", and its commentary. Continuous observation of all bolted connections, except as noted below, for required size, location and number of bolts. Verify that the specified procedure for installation is properly used for tightening bolts. Periodic observation of 50% of bolted connections installed using the direct tension indicator method or alternate design fastener (twist-off bolt) method for required size, location and number of bolts. Verify that the specified procedure for installation is properly used for tightening bolts.

5. Welding	2 (AWS) 2 (ASNT) 2 (AWS)	Prior to fabrication, obtain and verify Welding Procedures Specifications (WPS) are followed and are performed by qualified welders, both in the shop and in the field. **Section 1705.2.2.1., Table 1705.2.2.** Complete and partial penetration groove welds: submit all Prequalified Complete and/or Partial Penetration Groove Weld Details. Ultrasonic test 100% of all welds. Multi-pass fillet welds: visual inspection of 100% of all shop welds if fabricator is not certified as noted in Item 1. Visual inspection of 100% of all welds and all passes being performed every third working day if fabricator is certified as noted in Item 1. Visual inspection of 100% of all field welds and all passes. Magnetic particle test 5% of all field welds for each pass. Single-pass fillet welds larger than $^{5}/_{16}$": see Multi-pass fillet welds for details except that there is only a single pass to be inspected. Also, Magnetic particle test 10% of all field welds. Single pass fillet welds smaller than $^{5}/_{16}$": visual inspection of 50% of all shop welds if fabricator is not certified as noted in Item 1; this percentage may be reduced after fabrication starts if approved by the SER. Visual inspection of 50% of all welds being performed every third working day if fabricator is certified as noted in Item 1; this
6. Shear Connectors	2	Not Applicable.
7. Structural Details	1	**Section 1705.2.1.** Visual inspection of the erected steel frame to verify compliance with details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint
8. Metal Deck	2 (AWS)	Verify that welders are certified in accordance with AWS D1.3-98. Inspect 50% of weldments and side-lap fastening for required size, location and number for conformance
9. Other		

Cold-Formed Steel Framing

Item	Agent No. (Qualif.)	Scope
1. Member Sizes	1	**Section 1707.4.** Visual inspection of 50% of the erected cold-formed steel framing to verify compliance with details shown on the contract documents and approved shop drawings.
2. Material Thickness	2	**Section 1707.4.** Verify that 25% of the material thicknesses are in conformance with the contract documents and approved shop drawings.
3. Material Properties and Material Certification	1 1	**Section 1707.4.** Review material certification submittals to verify conformance with contract documents Inspect cold formed steel members, fasteners, and weld filler material for proper materials identification markings as required by the approved drawings.
4. Mechanical Connections	1	**Section 1707.4.** Inspect 25% of threaded fasteners, bolting, anchoring, powder actuated fasteners, and other fastening of components to verify conformance with the contract documents and approved shop drawings.
5. Welding	2 (AWS)	**Section 1705.11.3.** Verify that welders are certified in accordance with AWS D1.3-98. Inspect 50% of all welds to verify conformance with the contract documents and approved shop drawings.
6. Framing Details	1	**Section 1707.4.** Visual inspection of the erected cold-formed steel frame to verify compliance with details shown on the contract documents and approved shop drawings, such as bracing stiffening, member locations and proper application of joint details at each connection.
7. Other	1	**Section 1707.4.** Review design calculations by manufacturer's engineer and shop drawings to verify adequacy of design and details for conformance with the contract documents. The manufacturer's engineer will seal design calculations.

Prefabricated Cold-Formed Trusses

Item	Agent No. (Qualif.)	Scope
1. Fabricator Certification / Quality Control Procedures	1 1 1	**Sections 1704.2.5.2.** Verify whether the cold formed truss Fabricator participates in the "Truss Plate Institute's Quality Assurance Inspection Program If so, special inspections as required by Section 1704.2 shall not be required. If not, perform the following: Prior to fabrication, verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control and workmanship and the fabricator's ability to conform to the approved construction documents and referenced standards. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work. At the completion of fabrication, the approved fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the approved contract documents.
2. Material Thickness	1	Verify that 25% of the material thicknesses are in conformance with the contract documents and approved shop drawings.
3. Material Properties and Material Certification	1 1	Review material certification submittals to verify conformance with the contract documents. Inspect light gage steel members, fasteners, and weld filler material for proper materials identification markings as required by the approved drawings.
4. Mechanical Connections	1 (AWS)	Review 50% of truss connection plates for gauge thickness, size and location. Inspect 50% of threaded fasteners, bolting, anchoring, powder actuated fasteners, and other fastening of components to verify conformance with the contract documents and approved shop drawings.

5. Welded Connections	2 (AWS)	Review 50% of truss connection plates for gauge thickness, size and location. Verify that welders are certified in accordance with AWS D1.3-98. Inspect 50% of all welds to verify conformance with the contract documents and approved shop drawings.
6. Fabrication	1	Review 75% of prefabricated trusses for general conformance with the contract documents and approved shop drawings.
7. Framing and Details	1	Review completed truss and supporting framing installation prior to concealment by surface finishes for compliance with details shown on the construction drawings and approved truss shop drawings including all connections to the supporting structure. Review 25% of all bearing points and all permanent bracing if required by fabricator and the architect or engineer of record.
8. Other		

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

Temporary utilities include, but are not limited to, the following:

1. Sewers / septic and drainage.
2. Water Service and distribution.
3. Stormwater control within building
4. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Temporary Heating.

Security and protection facilities include, but are not limited to, the following:

9. Environmental protection.
10. Stormwater control. (SWPPP)
11. Tree and plant protection.
12. Site enclosure fence.
13. Security enclosure and lockup.
14. Barricades, warning signs, and lights.
15. Covered walkways
16. Temporary enclosures.
17. Site road access and traffic control (NYS DOT Work Zone traffic control plan)
18. Temporary partitions.
19. Fire protection.

Unless work of this section is indicated to be provided under a specific contract, each Prime Contractor must provide, maintain and remove required temporary facilities necessary to perform his own construction activities.

Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.2 QUALITY ASSURANCE

Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations,” ANSI A10 Series standards for “Safety Requirements for Construction and Demolition,” and NECA Electrical Design Library “Temporary Electrical Facilities.”

6. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code.”

Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.3 PROJECT CONDITIONS

Temporary Utilities: Each contractor will prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-preventive measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

1.4 DIVISION OF RESPONSIBILITIES

General: These Specifications assign the Contractor responsibilities.

Each Prime Contractor is responsible for the following:

1. Installation, operation, maintenance and removal of each temporary facility considered as its own normal construction activity, as well as the costs and use charges except as listed below.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Generator power for their own work, until new electrical service has been activated and EC Prime has set temporary panel(s)

4. Its own storage, lockable Conex boxes and fabrication sheds. (Locate/Move as directed by CM)
5. Hoisting requirements, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure. (Rigging insurance must be provided when contractor hoisting equipment)
6. Collection and disposal of its own waste material.
7. Secure lock-up of its own tools, materials and equipment.
8. Construction aids PPE and miscellaneous services and facilities necessary exclusively for its own construction activities.
9. Maintaining temporary facilities provided by Contractor.
10. Containers for non-hazardous waste and debris generated by their own removals and construction operations.

1.5 USE CHARGES

General: Cost or use charges for temporary facilities are not chargeable to Owner, Architect or Construction Manager and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. The Architect and Construction Manager
2. Other Contractors.
3. Owners construction forces, including testing agencies
4. Personnel of authorities having jurisdiction.

Water Service: Each contractor needs to provide their own water until new water service is installed and activated to a temporary connection location by the Plumbing Contractor.

Electric Power Service: Temporary electric power including set-up and maintenance is the responsibility of the Electrical Contractor. Use charges by owner.

PART 2 - PRODUCTS

2.1 MATERIALS

General: Provide new materials. If acceptable to the Architect / CM, the Contractor may use undamaged, previously used materials in good condition. Provide materials suitable for use intended.

Lumber and Plywood:

1. For signs and directory boards, provide exterior-type, Grade B-B high density concrete form overlay plywood of sizes and thicknesses indicated.

2. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

2.2 EQUIPMENT

Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Protect adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.

Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

1. Arrange with utility company CM and Owner to make connections for temporary services.

3.2 CONTRACTOR FIELD OFFICES

If sufficient space can be provided onsite, Contractors may with permission from the construction manager establish a field office for their own use. Said offices for the individual prime contractor, sub-contractors, specialty contractors and the like shall be of such size and design as approved by the CM and shall be located in the Construction Managers designated staging area. Each representative contractor will arrange for telephone service and electric service, if required, directly with the utility company.

Maintain onsite, all articles for First Aid treatment. The contractor shall also establish standing arrangements for the immediate removal and hospital treatment of any employees and other persons on the job site who may be injured or who may become ill during the course work.

3.3 TEMPORARY AND PERMANENT SERVICES, GENERAL

The Contractor's use of any permanent system or service of the building or portions thereof shall be subject to the Owners approval.

The Contractor shall be responsible for any and all damage to permanent services used, and shall make good any and all damage to the satisfaction of the owner, prior to final completion and acceptance.

NOTE - In accordance with OSHA and other applicable regulations, the representative Contractors performing erection of structural "skeleton" type work are solely responsible for the netting, guard rail protection and such other safety devices as deemed necessary to protect the workers and public from harm.

3.4 TEMPORARY LIGHT AND POWER

Temporary Electric Power Service: **Electrical Contractor** shall provide and pay all costs to provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period.

1. Responsibility: All work under this section to be provided by the **Electrical Contractor.**
2. **Electrical Contractor shall make all arrangements with utility company for temporary service from Southbrook Road immediately after award of contract. This includes utility poles, power cable, temporary meter, 200-amp panel and all other items necessary for construction until the building is ready to receive the permanent service. Pole spacing will be sufficient to maintain a minimum wire elevation of 15' above grade. Exterior Weatherproof Panel will be located on the outside of the building adjacent to the Apparatus Bay Doors (independently supported). Subpanel location(s) inside building as directed by Construction manager.**
3. Temporary services for temporarily or permanently installed building equipment such as sump pumps, boilers, cabinet heating and/ or cooling units and fans shall be furnished, installed, operated and maintained so that the said equipment may be operated for drainage and temporary heat when required and/ or when so ordered by the Architect/ Construction Manager.
4. Electrical Contractor shall maintain all parts of the electrical system (temporary and permanent power) active and in-service at all times throughout the contract duration as governed by the Construction Manager. All temporary lighting to be controlled by standard switches per code (outside of power panels).
5. Electrical contractor shall provide temporary generator power to maintain power during the electric service switch over. This includes all electric service in the building (power, fire alarm, lighting heating units, etc). Contractor shall assume a minimum of (2) 50 kw generator(s) and temporary panels as necessary. Generators shall be located at the building exterior. Provide feeder

cables, adequately sized, in accordance with NEC to feed temporary panels or existing sub-panels. Contractor shall include required fuel for operation.

6. Electrical Contractor shall maintain power during the hours established by Construction Manager.

7. Temporary Service: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protected disconnect and main distribution switch gear. Comply with all NECA, NEMA and UL Standards

8. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.

9. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead. Rise vertically where wiring will be least exposed to damage from construction operations.

10. Provide metal conduit, tubing or armored cable for protection of temporary power wiring where exposed to possible damage during construction operations. Where permitted by code, wiring of circuits not exceeding 110-120 Volt 20 Amp rating and wiring of lighting circuits may be non- metallic sheathed cable in areas where located overhead and exposed. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide metal enclosures or boxes for wiring devices.

11. Provide overload-protected disconnect switch as required by code.

TEMPORARY ELECTRICAL AND TELEPHONE SERVICES

12. Electrical Contractor shall provide temporary power and lighting facilities for use of all trades. All temporary light and power shall be in accordance with the required Codes and Safety Standards.

13. Electrical Contractor will include in their base bid: Construction Manager trailer with: a) 100 amp power, b) Internet connection, within 5 days after notification by CM. Lines will be run in conduit below grade and/or install utility poles as necessary.

14. All other contractor trailer use / connection charges for power or internet to be paid for by the respective contractor.

TEMPORARY POWER DISTRIBUTION

15. General Requirements: Electrical Contractor shall provide feeders and branch circuits of adequate size and proper characteristics as required to supply temporary receptacle and lighting loads. Size service and feeder conductors to restrict voltage drop to maximum 5 percent at 80 percent power factor. Provide properly sized overcurrent protection for each temporary electrical circuit.

RECEPTACLE REQUIREMENTS

16. General Requirements: Provide temporary receptacle outlets as required Minimum Requirements: Provide a minimum of one quad 120-volt receptacle per 2500 square feet of building floor area, with maximum spacing of 50 feet on

center for operation of portable tools and appliances during the construction period.

17. Branch Circuits: All temporary receptacle branch circuits to be rated 20 amps with a maximum of (3) duplex receptacles per circuit. Temporary receptacle branch circuits shall be independent of temporary lighting circuits.

LIGHTING REQUIREMENTS

18. General Requirements: Electrical Contractor shall provide both interior and exterior lighting at areas as required to provide adequate illumination for safe and proper construction operations and Project Site security.

19. Minimum Requirements: Provide illumination levels adequate for construction operations and safe traffic conditions. As a minimum provide one 200-watt lamp per 400 square feet of building floor area, with maximum spacing of 20 feet. Any rooms in excess of 500 sf will receive one 400-watt metal halide fixture for each 1000 sf of area. (or LED equivalents) .

20. Stairways: Provide one 200-watt lamp per landing at each stairway and covered walkway.

21. Supplemental Lighting: If required, supplemental lighting beyond minimum requirements shall be provided via suitable portable lighting units with cord and plugs, and shall be paid for by the Contractor or Sub- Contractor requiring such additional lighting.

22. Branch Circuits: All temporary lighting branch circuits to be loaded to a maximum of 1400 watts per 20 amp circuit. Temporary lighting branch circuits shall be independent of temporary receptacle circuits.

23. Restrictions: Do not use permanent lighting systems for temporary construction lighting purposes.

MAXIMUM LOADS

24. General: Lighting and power loads connected to the temporary power distribution system shall be limited to the following maximum individual loads:

	Load Type	Maximum
a.	Load Type	Maximum
b.	120 volt, 1-phase	1.5 KVA
c.	208 volt, 1-phase	2.5 KVA
d.	208 volt, 3-phase	5.0 KVA

25. General: The temporary power distribution system shall be sufficiently sized to provide temporary power as required within this section. Meter and Meter connections to be part of electrical contractors base bid.

ELECTRICAL WELDERS

26. Separate Power Sources Required: Power for electric welders and for other loads larger than the maximum allowable sizes shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

ELECTRICAL ENERGY COSTS

27. Paid By Owner: Charges for electrical energy usage for temporary power and lighting will be paid by the Owner, when taken from the Owner's electrical services. Contractor and Sub-Contractors shall exercise measures to conserve energy usage. Use of owner electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted

3.5 TEMPORARY TOILET FACILITIES

Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs. Existing facilities should not be used.

Responsibilities: The **General Contractor** is responsible for temporary sanitary facilities and their maintenance, cleaning and supplies for use by all trades for the entire duration of the project. Sufficient quantity/locations to properly handle the amount of workers onsite.

Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility, including Owner's Representative's temporary offices for full contract duration. Provide covered waste containers for used material.

Provide separate toilet facilities for male and female construction personnel.

Provide separate toilet facilities for Construction Manager personnel located at direction of Construction Manager.

3.6 TEMPORARY HEATING

The **Mechanical Contractor** will maintain 60-degree temperature in all areas via temporary systems. The Mechanical Contractor will submit a detailed plan including sketches indicating his proposed temporary heating system for engineer approval within 4 weeks of contract award. The **Electrical Contractor** will provide permanent or temporary power for the Mechanical Contractor's units for temporary heating. **General Work Contractor** will have the building shell completed including roofing, windows / doors installed and the work areas fully enclosed. (Any missing components at time of temporary heat activation will be enclosed via ½" plywood, 2" rigid polyiso and 6 mil poly sheathing for a weather-tight insulated enclosure.). **Temporary Heating will be provided from November 1, 2021 thru March 31, 2022**.

The fuel, equipment, materials, operating personnel and methods used therefore shall be at all times satisfactory to the Construction Manager and adequate for the purpose intended. The use of electric heaters is not acceptable. All required fuel is part of the **Mechanical contract.**

The Contractor shall maintain the critical installation temperatures provided in the technical provisions of the specifications herein for all work in those areas where same is being performed.

Before and during the placing of gypsum and the application of other interior finishes, taping, varnishing, painting, etc. and until final acceptance by the Owner of all work covered by the Contract, the contractor shall, unless otherwise specified in the contract documents, maintain a temperature of 60 degrees F. Coordinate with Division 9 of the Technical Specifications.

Use of the permanent system, **if approved by engineer and owner permission granted, shall not shorten, or negate any equipment, or system guarantees** required under this contract. (the warranty period starts upon date of substantial completion). Two additional filter changes are to be provided by the Mechanical Contractor. A program of use, maintenance and restoration will be submitted with request for use of systems for temporary services.

3.7

TEMPORARY WATER

Sitework contractor will bring in a temporary water service for all contractor's use to within 20' of the building footprint. Sufficient supply for minimum 1" line with at least 15 gallons/minute supply. This service will be required until the Sitework contractor provides the activated permanent water service to 5' of building. (Sitework Contractor is responsible for all permits, wet tap, connections, etc).

Once the water service line is activated the **Plumbing** Contractor shall perform the following temporary services.

Provide and maintain a temporary water system of size and capacity as required below to supply the needs of all Contractors for the work.

1. Provide no less than two 3/4-inch hose bibs conveniently located at each building wing.
2. Provide and pay for all connections
3. Protect temporary and permanent lines against any damage.

Each Contractor shall:

4. Provide all hose and other extensions from connections installed by the Plumbing Contractor and all labor, materials and supplies required to supply water to the work.
5. Prevent water damage to the work.

3.8 STORAGE FACILITIES

Each Contractor shall provide temporary storage and other facilities as required for their own use. Temporary structures shall be located at the Construction Manager's

designated staging area, and shall be removed upon completion of the work or when directed.

Materials delivered to the site shall be safely stored and adequately protected against loss or damage in watertight, lockable, Conex boxes. Particular care shall be taken to protect and cover materials that are liable to be damaged by the elements.

Due to limited on site storage space, each Contractor shall coordinate delivery of his materials with the Construction Manager who will determine when large deliveries shall be made and shall be designate storage locations on site for delivered materials. All stored materials must be stored in locked, watertight trailers, paid for by applicable contractor.

3.9 SCAFFOLDING AND STAGING

All scaffold, staging and appurtenances thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.

3.10 RUBBISH CONTAINER

Each Contractor shall provide suitable rubbish container device(s) for his own use, properly maintained and serviced, replaced as required and protected from access by the public fencing as may be specified herein or approved by the Architect or Construction Manager.

Each Prime Contractor and Subcontractor shall sweep up and gather together daily all his own rubbish and removed materials and place same in containers.

3.11 CONSTRUCTION FENCING

All Construction Site fencing shall be provided and maintained by the **Site Contractor**, as outlined in Site Staging plan located at the back of this section. Temporary construction fencing shall be of good quality and neat in appearance; 6’ high chain link fencing, 9 ga fabric. Open-Mesh Chain Link Fencing: Provide 0.120-inch-thick, galvanized steel posts, and 2.875" dia. Gate posts. Provide lockable gates. (Keys to owner, architect and CM).

Additional 3’ high orange safety fence will be installed/maintained in locations as identified on the Site Staging plan.

Site access gates shall be provided as required, complete with all operating hardware and security devices.

Should fencing be required to be relocated or modified during the course of the project due to additional access needed by the contractor, same shall be done at the total expense of the contractor.

3.12 JANITORIAL SERVICE/DAILY CLEANUP

Each Contractor shall furnish daily janitorial services for the project and perform any required maintenance of facilities as deemed necessary by the Construction Manager during the entire life of the contract. If any contractor fails to keep the site safe and broom clean within 4 hours of being notified by CM, either verbally or in writing, the construction manager will have the cleanup work performed by others and the contractors will be back charged accordingly.

1. In addition to the above, the **General Contractor** shall provide a daily sweep and a weekly damp mop of all work areas.

3.13 BURNING

Burning will not be permitted.

3.14 FIRE PREVENTION CONTROL

Each Contractor shall comply with the safety provisions of the National Fire Protection Association's "National Fire Codes" pertaining to the work and, particularly, in connection with any cutting or welding performed as part of the work.

3.15 TEMPORARY FIRE PROTECTION

Each Contractor shall take all possible precautions for the prevention of fires.

1. Where flame cutting torches, blow torches, or welding tools are required to be used, their use shall be as approved by the Construction Manager at the site.
2. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.

Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.

No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.

Each Contractor shall comply with the following requirements relating to compressed gas:

3. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.
4. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they

shall also be required by the Contractor to read Part 3 of Pamphlet P-1 “Safe Handling of Compressed Gases” published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.

Each Contractor shall comply with the following requirements relating to welding and cutting:

5. All cutting and/or welding (electric or gas) must be done only by skilled, certified and licensed personnel.
6. During welding or cutting operations, a contractor’s man shall act as a fire watcher. The fire watcher shall have proper eye protection and suitable firefighting equipment including fire extinguisher (bearing current inspection Certificate), protective gloves and any other equipment deemed necessary.
7. Tanks supplying gases for welding or cutting are to be placed in an upright position securely fastened, and close as practical to the operation. Tanks, actives or spares, shall be protected from excess heat and shall not be placed in stairways, hallways or exits. When not in use, protective valve cap shall be screwed on the cylinder.
8. Adequate fire extinguishing equipment shall be maintained at all welding or cutting operations.

3.16 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION:

General Contractor will provide temporary ventilation as required for protecting the building from any adverse effects of high humidity during construction activities. Select dehumidification and ventilating equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements and have sufficient quantity of units to produce necessary ambient conditions.

1. Each Contractor shall be responsible for his own temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
2. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
3. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.
4. If Contractor fails to adequately ventilate the building during the construction, abatement / roofing process, thereby causing humidity and possible mold issues, the owner will hire others to properly address and deduct costs from the Contractor accordingly.
5. Any contractor allowing water infiltration to building is responsible for cleanup and commercial dehumidifiers of sufficient size/qty to prevent mold growth. Failure to immediately address (4 hours’ notice) will result in the owners hiring others and back-charging in order to insure a safe environment.

3.17 TEMPORARY ROADS, TRACKING PADS, PARKING AREA AND CONCRETE WASHOUT PITS:

Site Contractor shall construct and maintain temporary road areas, tracking pads and parking area, adequate to support loads and to withstand exposure to traffic during construction period.

1. Temporary roads/ Parking Area /Tracking pad areas will consist of one-layer soil separation fabric, 8" of compacted NYS DOT Item 4. Contractor will maintain and field dress with additional material as necessary to prevent ruts and potholes.
2. Above work includes access for delivery to building work areas, and to equipment and storage areas and sheds.
3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust. Contractor must maintain dust control on a continuous basis.

Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The Site Contractor will clean any construction-related dirt/debris from Town and State roadways throughout the duration of the project. Temporary parking by construction personnel shall be allowed only in areas so designated.

4. General Work Contractor is responsible for all snow and ice removal throughout project. This includes, temporary roadways, contractor parking, CM trailer and access to staging areas. Stockpile snow in areas as designated by Construction Manager.
5. General Work Contractor – is responsible to maintain the (Sitework Contractor provided) concrete washout pits for their concrete construction activities.

3.18 DE-WATERING FACILITIES AND DRAINS

Each Prime Contractor is directly responsible for de-watering of their excavations. The responsibility of de-watering of the site as to facilitate the work will be the responsibility of the Sitework Contractor, coordinate with CM. See De-watering pit detail on drawing sheet 19/20 for pit requirements which pertain to both SC & GC for their scope of work.

Comply with requirements in applicable Division 31 Sections for temporary drainage and de-watering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

Once the building roofing is watertight, the Plumbing Contractor will install temporary drainage piping from his roof drain locations to shed the water to 100' away from the building.

3.19 ROOF PROTECTIONS

All Contractors shall provide temporary protection on the roof surface to insure there is no damage when it is necessary for work to take place on completed sections.

3.20 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS

The **Site Contractor** shall provide signs for the NYS DOT signs per site drawing 7/18.

The **General Contractor** will install signs where required or indicated below to inform public and persons seeking entrance to project. All signage and posts become the property of the owner at the conclusion of the project.

Construct signs in accordance with section 619 of the NYS DOT standard specifications (MUTCD overall sign size, letter size, metal signage). Support on breakaway metal posts or attach to fencing; do not attach signs to buildings or permanent construction.

Include relocating temporary site safety and directional signs as many times as required or directed.

For construction traffic control/flow at entrances/exits, as designated by the Owner (4 required) Large sign 4' x4' Orange with Black Letters ("Construction Entrance Only")

To direct visitors (2required)

For construction parking (2 required)

To direct deliveries (2 required)

Per OSHA standards as necessary

For "No Smoking" safe work site at multiple locations (12 required)

Construction Area – Do Not Enter (30) mount on fence

No Trespassing (30) mount on fence

A premobilization meeting to establish location and quantities of all signage will be held with the General Contractor, Construction Manager, and owner. Prior to the start of any actual work the signage must be reviewed / approved by the Construction Manager.

3.21 STORMWATER CONTROL

The **Sitework Contractor** shall provide earthen embankments, silt fence, haybales, and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains during sitework activities.

Sitework Contractor- see drawings and Division 31 sections for requirements and maintaining SWPPP compliance for this contract.

3.22 BARRICADES, WARNING SIGNS AND LIGHTS:

Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.

3.23 TEMPORARY ENCLOSURES

General Contractor will provide temporary 2” x4” wood framing, 2” polyiso insulation, ½” plywood, and cover with 6 mil plastic; at any open exterior window and door entrance locations, louvers etc. for weather and security protection at the end of each workday. (This includes the overhead door locations at the apparatus bays).

Any other temporary enclosures for specific openings for a contractor to perform their work are the responsibility of the contractor creating the opening and shall be installed to protect the building from exterior elements, security issues, odors / noise resulting from construction.

3.24 TEMPORARY DUST PARTITIONS and FLOOR PROTECTIONS

General Contractor shall erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate work areas from fumes.

1. Construct dustproof, floor to ceiling partitions of not less than 3-5/8” – 20 ga. studs, 2 layers of 6 mil poly sheets inside, exterior sheathing 5/8” plywood. Caulk seal joints and perimeter to prevent dust migrations.
2. Temporary Floor Protections – Shall be “Ram-Board” **Heavy Duty** with taped joints or equivalent. Finish Flooring (new or existing) will be fully covered by **General Contractor**. Areas of isolated MEP work will be protected with Ram-Board by the individual prime contractor

3.25 OPERATION, TERMINATION, AND REMOVAL

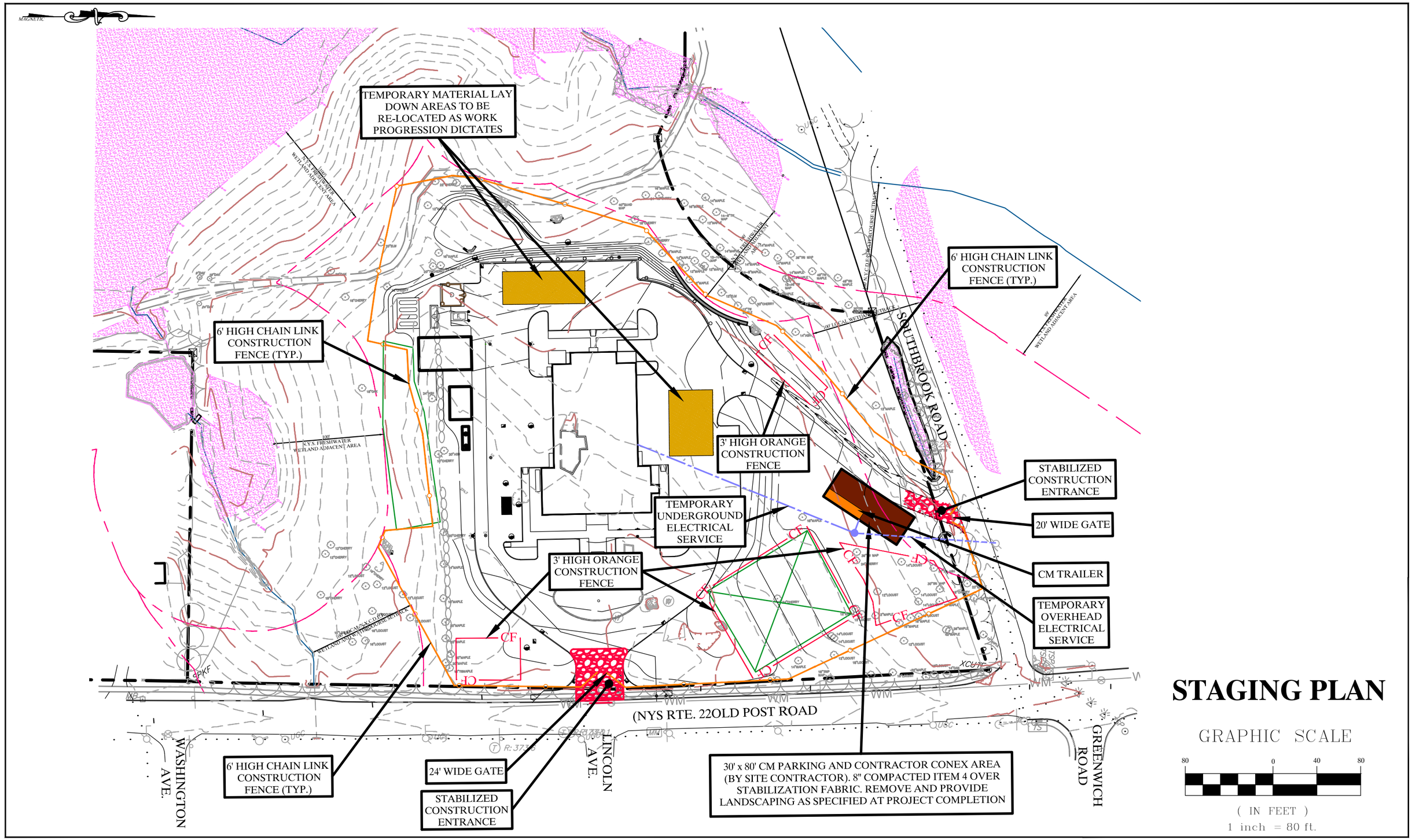
Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

Termination and Removal: Unless the Architect/ CM requests that it be maintained longer, remove each temporary facility when the need has ended or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been affected because of interference with the temporary facility.

Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractors property.
2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including.

END OF SECTION



STAGING PLAN

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and product substitutions.

B. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

D. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.3 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

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a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Submittal: Within 10 days after date of Notice to Proceed, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

B. Substitution Requests: Submit all requests for substitution products within ten days after receipt of Notice to Proceed. Requests for substitution received after this time may be considered or rejected at the discretion of the Architect. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Submit three copies of each request for substitution for consideration.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
b. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
d. Samples, where applicable or requested.
e. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
f. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
g. Cost information, including a proposal of change, if any, in the Contract Sum.
h. Contractor's certification that proposed substitution complies with requirements or is superior in quality to the product specified in the Contract Documents and is appropriate for applications indicated. Include the Contractor's waiver of rights to additional payment or time, that may

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subsequently become necessary because of the failure of the substitution to perform adequately.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Mechanical Materials and Equipment: When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

D. Sitework Materials: All products submitted for use and incorporated into this project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.

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7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

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7. A named product and model number establishes the characteristics and salient features of the specifications even when they are not fully described.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures for product selection include the following:

1. Where Specification paragraphs or subparagraphs name a single product and manufacturer, provide the product named. No substitutions will be permitted, unless accompanied by the term "or equal," “or equivalent,” or "or approved equal. " Comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
2. Where Specification paragraphs or subparagraphs introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements. No substitutions will be permitted, unless accompanied by the term "or equal," “or equivalent,” or "or approved equal. " Comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product by one of the other named manufacturers.
4. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

    a. Where products or manufacturers are specified by name, accompanied by the term "or equal," “or equivalent,” or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

5. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

6. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

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a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. General installation of products.
2. Coordination of Owner-installed products.
3. Starting and adjusting.
4. Protection of installed construction.
5. Correction of the Work.
6. Requests for Information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

3.3 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS

A. Review of Contract Documents and Field Conditions: Carefully study and compare the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, and prior Project correspondence and documentation prior to submitting an Request for Information. Immediately on discovery of the need for clarification of the Contract Documents, submit a Request for Information (RFI). Include a detailed description of problem encountered, together with recommendations or proposed solutions to the question.

B. Requests for Information (RFI's) are requests for clarifications or questions regarding the contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, are they to be as a means to describe or request approval of alternate construction means, methods or concepts or substitution for materials, systems means and methods.

1. Preparation:

   a. Submit a separate RFI for each unrelated question or clarification required.
   b. Number each RFI sequentially in a manner to be coordinated with the Architect. Any numbering scheme must be acceptable to the Architect.
   c. Reference the specification section and the drawings and details that need clarification in the RFI.
   d. State clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Architect. In the Request for Information, the contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
   e. Submit RFI's as directed, to the Architect's office.
   f. The Architect will not fill in incomplete RFI information on the Contractor's behalf.
   g. When indicating the date required, fill in an exact date, not "ASAP" or "IMMEDIATELY."
   h. Generate and maintain an RFI log and provide weekly updates to the Architect.

2. Processing: Allow sufficient review time so that Work will not be delayed as a result of the time required to process RFI's. RFI's are an expected and anticipated part of the Work. Effort associated with the RFI process will not be accepted as a reason for delay or additional compensation.

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a. Based upon the amount of RFI's received and their level of content, the Architect will establish the level of importance of each RFI and allow sufficient time in the Architect's professional judgement to permit adequate review.
b. All RFI's will be answered in writing, verbal decisions are not valid.
c. If an RFI is submitted that is obviously the result of the Contractor's disregard or apathy, the RFI will be returned and note "Review Drawings" or "Review Specifications."

3. Responses from the Architect will not change any requirements of the contract documents.
4. The Contractor is not entitled to upward adjustments to Contract Time or Sum for any activity related to processing RFIs.
5. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's Requests for Information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.
6. Misuse of RFI's:

a. Substitutions shall not be submitted as an RFI and will be returned and note "Submit as a Substitution."
b. RFIs are not to be used as a form of correspondence for the project.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain maximum headroom clearance in spaces without a suspended ceiling.

B. Mechanical Installations: Comply with the following requirements:

1. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
2. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
3. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

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C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

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.

H. 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.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

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C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Divisions 02 - 49 Sections.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017000

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SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

   a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 21 through 28 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

C. Division of Responsibilities for Cutting and Patching Work: Each Contractor shall perform cutting and patching required for its portion of the Work. The requirements of this section apply, in general, to all Contractors, even though certain items of work may be applicable to a specific Contractor.

1.2 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding (see Article 1.4 below), submit a proposal describing procedures at least 14 days before the time cutting and patching will be performed requesting approval to proceed. Include the following information, as applicable, in the proposal:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.

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5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Minimize cutting and patching of work by properly coordinating construction sequences with Architect.

B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

1. Obtain Architect's approval before cutting and patching any structural work that is not indicated on drawings.

C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Obtain Architect's approval before cutting and patching any operational element that is not indicated on drawings.

D. Miscellaneous Elements: Do not cut and patch the following elements or related components, that are not indicated on drawings, in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.
4. Piping, ductwork, vessels, and equipment.
5. Noise- and vibration-control elements and systems.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.3 PERFORMANCE

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

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

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2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where portions of walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch, from wall-to-wall or corner-to-corner. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

SECTION 01 74 00 - CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK:

A. The work of this section relates to the following:

1. Maintain all premises and public properties/roadways free from accumulations of waste, debris, dirt, mud and rubbish caused by operations on a daily basis.
2. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all sight exposed surfaces; leave project clean and ready for occupancy.
3. Remove all overspray caused by construction operations from adjacent construction, surfaces and vehicles.

B. Related Requirements Specified Elsewhere

1. Summary of work: Section 011000
2. Cleaning for Specific Products or Work: the respective sections of the specifications:

1.2 SAFETY REQUIREMENTS

A. Standards: Maintain project in accord with safety and insurance standards.

B. Hazard Control/Cleaning Products

1. Store volatile waste in covered metal containers and remove from premises daily.
2. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile waste such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of waste into streams or waterways.

PART 2 - PRODUCTS

2.1 Materials: Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.1 REQUIREMENTS DURING CONSTRUCTION:

A. Execute daily cleaning to ensure that building, grounds, and public properties and roadways are maintained free from accumulations of waste materials, rubbish, dirt, mud and dust.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. Each day, all contractors shall adhere to the following:

1. Areas of intense activity, such as cutting and sawing must be swept clean and reorganized at the end of each day. Utilize dust control methods such as plastic containment, containment hut and/or wetting of surfaces.
2. Areas of moderate activity such as installation of plumbing, ductwork, electrical work must be returned to good order at the end of each day.
3. Debris below scaffolds (and shoring/re-shoring) must at all time, be kept sufficiently consolidated to keep walkways free of tripping hazards. These work areas must also be swept clean immediately upon removal of scaffolds.
4. All swept up debris, waste materials, and packing must be removed and placed in the dumpster by the end of the workday.
5. All stored material must be protected and kept in good order.
6. As portions of the work are completed, all used and excess materials must be removed promptly.
7. Daily Clean-up and good housekeeping is the responsibility of each contractor individually and will be monitored by the Construction Manager. If any contractor fails to perform cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor(s) accordingly.
8. Contractors shall promptly comply with requests to organize scattered materials.

D. **Each Contractor** is responsible for furnishing all dumpsters or other such containers as required for collection, storage and legal disposal of all debris and rubbish resultant from their construction operations. The Construction Manager shall locate and request to move such containers as necessary and legally dispose of waste as containers are filled. Separate and recycle as required authorities and regulations.

E. Vacuum clean areas when ready to receive finish painting, and continue vacuum cleaning on an as needed basis until building is ready for Substantial Completion or occupancy.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other containment resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING

A. Each Contractor Shall:

1. Employ professional cleaners for final cleaning.
2. In preparation for substantial completion or occupancy, conduct final inspection of sight exposed interior and exterior surfaces, and of concealed spaces.
3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials form sight-exposed interior and exterior finished surfaces; polish surface so designated to shine finish.
4. Maintain cleaning until project, or portion thereof, is occupied by owner.
5. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.
6. If the contractor fails to perform final cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor accordingly.

B. Sitework Contractor: shall complete the following restoration operations before requesting inspection for certification of Substantial Completion for entire Project or portion of Project:

1. Restoration of any lawn areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, etc.
2. Magnet sweeping of all exterior lawn areas to ensure that no stray nails / screws, etc. remain in lawn areas.
3. Power sweep all asphalt areas using a commercial street sweeper (water method)
4. Remove any stickers, protective coverings, etc.

C. General Contractor: shall complete the following restoration operations before requesting inspection for certification of Substantial Completion for entire Project or portion of Project:

1. Restoration of any lawn and walk/curb areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, cranes, etc.
2. Magnet sweeping of all exterior lawn areas to ensure that no stray nails / screws, etc. remain in lawn areas.
3. Hire professional cleaning company (not construction tradesmen) to thoroughly clean all surfaces, including glass, floors, carpeting, ceramic tile, doors, windows, casework, etc.

4. Wax resilient tile, linoleum, terrazzo floors using the exact same products / coats as the owner's custodial staff for compatibility purposes. Vacuum all carpet areas
5. Power sweep all asphalt areas using a commercial street sweeper (water method)
6. Remove any stickers, protective coverings, etc.
7. Clean all casework, tables, equipment etc. inside and out.

D. Mechanical Contractor: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.

1. Clean all Mechanical units, including removal of any stickers, protective covering. Wipe down of all unit surfaces for clean streak free surfaces
2. Vacuum out all ductwork, grills / louvers to insure there is no construction debris or dust
3. Replace all air filters at no additional cost immediately prior to owner occupancy
4. Restoration of any lawn and walk/curb areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, cranes, etc.

E. Electrical Contractor: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.

1. Clean surfaces of all electrical equipment from any dust. Remove any labels or protective films
2. Replace any burned out or non-functioning bulbs

F. Plumbing Contractor: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.

1. Remove any stickers, protective coverings, etc.
2. Clean all drains and plumbing fixtures inside and out.

G. Fire Protection Contractor: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.

1. Remove any stickers, protective coverings, etc.
2. Clean all equipment and devices

3.3 RUBBISH REMOVAL

A. Contractors shall comply with all Local, State and Federal Laws, Codes and Requirements regarding recycling and trash or rubbish removal.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Substantial Completion & Inspection procedures.
   2. Project record documents.
   3. Operation and maintenance manual submittal.
   4. Start-Up and adjustments
   5. Spare Parts.
   6. Demonstration & Training.

B. Closeout requirements for specific construction activities are included in the appropriate Sections.

C. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of all prime contractors.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise the Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra stock, and similar items.
   7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements. Start-up of existing removed/replaced rooftop HVAC units will include written confirmation from contractor's mechanical subcontractor that all systems are adjusted and functioning properly.
9. Complete final cleanup requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred, exposed finishes.

B. Initial Inspection: Conducted between Construction Manager and Contractor, once all incomplete items identified are completed, a request for review by the Architect shall be made.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Architect will repeat inspection when requested and assured that the Work is substantially complete. Note that multiple inspections due to contractor not being complete will result in a charge to the Owner in which the amount shall be deducted from said contractor via change order.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
   2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
   4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
   5. Submit consent of surety to final payment.
   6. Submit a final liquidated damages settlement statement.
   7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   8. All items in the Construction Checklist must be received and approved prior to any retainage reduction.

B. Re-inspection Procedure: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.

1. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. Note that multiple inspections due to contractor not being complete will result in a charge to the Owner in which the amount shall be deducted from said contractor via change order.
2. If necessary, re-inspection will be repeated, but may be chargeable to the Owner and back-chargeable to the Contractor in conditions within his control.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Construction Manager and Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
   3. Note related change-order numbers where applicable.
   4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
   1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
   2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
   3. Note related record drawing information and Product Data.
   4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
   1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
   2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.

3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-3 inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
   1. Emergency instructions.
   2. Spare parts list.
   3. Copies of warranties.
   4. Wiring diagrams.
   5. Recommended "turn-around" cycles.
   6. Inspection procedures.
   7. Shop Drawings and Product Data.
   8. Fixture lamping schedule.

H. Waivers, guarantees, certification letters, AIA documents, etc.: See checklist attachment at the end of this section.

1.6 OPERATION AND MAINTENANCE DATA

A. CLOSEOUT SUBMITTALS
   1. Manual Content: Submit manual content formatted and organized as required by this Section.
   2. Format: Submit operations and maintenance manuals in the following format:
      a. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
   3. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
      a. Correct or revise each manual to comply with Architect's comments. Submit 3 copies of each corrected manual prior to commencing demonstration and training.
      b. Submit 3 copies of final manuals in electronic DVD format, as well.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information as described below.

a. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
b. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.
c. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Service and lubrication requirements.
   7. Demonstration and training video recording, if available.
d. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
e. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
f. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

A. Include procedures to follow and required notifications for warranty claims.

1.7 STARTING AND ADJUSTING

A. Work of this Section also includes any contract document stipulated man-hours that shall be provided by the prime contractors for startup participation of equipment and systems.
B. STARTING SYSTEMS
   1. The Contractor shall coordinate, schedule, and sequence the start-up of various equipment and systems.

2. Where the start-up of a system or piece of equipment is dependent upon the start-up of other system(s) or equipment, then the Contractor shall schedule and sequence the start-ups to coincide.
3. Notify the Architect at least 14 calendar days prior to the start-up of each item or system so that he can schedule the startup with the Owner and utilities.

C. Where applicable, verify that each piece of equipment or system has been checked for proper:
   1. lubrication
   2. drive rotation
   3. belt tension
   4. motor starter heater size
   5. fuse size
   6. water pressures
   7. terminal connections
   8. control sequence
   9. for conditions which may cause damage or delay the start-up procedure

D. Verify that the equipment has been installed in accordance with the manufacturer's requirements.

E. Complete all pre-startup checklists that may be required by the system vendor.
   1. In the event that start-up activities are delayed as a result of the Contractor's failure to properly check the completed installation and a manufacturer's representative is on the job site waiting for corrections to be made, then the Architect may, at his/her sole discretion, postpone start-up until such time as the corrections have been made without any extra costs.
   2. The Owner may deduct from money due the Contractor the excess cost of engineering associated with having the Architect present during the start-up.
   3. The deduction shall be equal to the Architect's effective billing rate times the total number of hours delayed during the start-up activities.

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

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

H. Execute start-up under supervision of applicable Contractor's personnel in accordance with manufacturer's instructions.

I. The Contractor shall have the job site superintendent present during all start-up activities.

J. Provide manufacturer's authorized technician at the site when specified and in accordance with the requirements contained in Section 014500 – Quality Control.

1.8 SPARE PARTS

A. QUALITY ASSURANCE
   1. Spare parts shall be delivered as complete assemblies direct from the manufacturer such that the part is fully functional and ready to be installed.

B. DELIVERY, STORAGE AND HANDLING OF SPARE PARTS
   1. Comply with the requirements of Section 016500 for packing, delivery, storage and handling requirements for all parts delivered to the site of the work.
   2. All spare parts required to be furnished under a Section of the Specifications shall be packaged in one separate box, crate, or container with the words “SPARE PARTS” lettered on all sides of the container.
   3. The equipment name or system name for which the spare parts are being provided shall also be lettered on the container.
   4. A separate packing list for the spare parts shall be included in the container.
   5. The Contractor shall store all spare parts indoors immediately upon delivery of the spare parts to the site. Spare parts will not be accepted by the Owner/Architect if the spare parts have been stored outdoors for more than 8 hours upon delivery to the site.
   6. The storage location shall be secure.

C. TURN OVER OF SPARE PARTS
   1. Spare parts shall be turned over to the Owner/Engineer approximately two (2) weeks prior to the Architect’s preparation of the Final Punch List.
      1. Spare parts will not be accepted until this time.
      2. The Certificate of Substantial Completion will not be issued until all spare parts are delivered.
   2. The following procedure shall be followed:
      1. The Contractor shall provide a formal letter of transmittal listing the name or description of the part, part number, model number, manufacturer (or supplier), and system component name and the Section where it was specified to be provided.

1.9 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
   1. Maintenance manuals.
   2. Record documents.
   3. Spare parts and materials.
   4. Tools.
   5. Lubricants.
   6. Fuels.
   7. Identification systems.
   8. Control sequences.
   9. Hazards.
   10. Cleaning.
   11. Warranties and bonds.
   12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:
   1. Startup.
   2. Shutdown.
   3. Emergency operations.
   4. Noise and vibration adjustments.
   5. Safety procedures.
   6. Economy and efficiency adjustments.
   7. Effective energy utilization.

C. Record "As-Built" Drawings
   1. Upon completion of the work, and review of the record drawings by the Architect, prepare a final set of record drawings using reproducible mylar or vellum. Submit final set of transparencies to Construction Manager and Architect. Contractor will also provide 3 ea. electronic copies of all as-builts on disk.
   2. The cost of furnishing above prints and preparing these record drawings shall be included in the contract price.

1.10 CLOSEOUT SUBMITTALS

A. See attached checklist for required wage & supplements, lien releases, guarantee/warranties, etc.

1.11 DEMONSTRATION AND TRAINING

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:
   1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.
   2. The entire training session will be video – recorded by the contractor and the owner provided with 3 copies of the training USB.

1.12 CLOSEOUT CHECKLIST

A. See attached checklist for required wage & supplements, lien release, guarantee / warranties, etc. No retainage reductions will be considered by the owner until receipt and approval of all closeout paperwork.

END OF SECTION

01 77 01 – CHECKLIST FOR PROJECT CLOSEOUT AND PROCESSING OF FINAL PAYMENT

PART 1 – GENERAL

1.1 Final payment will not be processed until all items indicated are received in accordance with Section 017701 – Checklist for Project Closeout.

1.2 Close-out Submittals:

[ ] Three (3) bound, hard cover, 3-ring binder brochures of Operation and Maintenance Manuals for all equipment installed on the project (1 additional electronic copy):

[ ] Typed or printed instructions covering the care and operations of equipment and systems furnished and installed.

[ ] Manufacturers instruction books, diagrams, spare parts lists covering all equipment.

[ ] Instruction of Owner's Representative in care and maintenance of new equipment.

[ ] All approved shop drawings.

[ ] Certificates of compliance and inspection. (Where applicable – electric, elevator, etc.)

[ ] Spare parts and Maintenance Materials. (Receipt signed by ACCI)

[ ] Evidence of compliance with requirements of governing authorities (Certificates of Inspection, Waste Manifests).

[ ] Certificates of insurance for products and completed operations.

[ ] Notarized statement that only non-asbestos materials were installed on this project.

[ ] Fully executed certificate of substantial completion: AIA G704.

[ ] Contractor's written one-year warranty and extended warranties (if any required).

[ ] Project Record Documents.

[ ] As-Built Drawings (1 full-size hard copy and 1 electronic copy).

1.3 Evidence of Payments and Release of Liens:

[ ] Contractor's Affidavit of Payment of Debts and Claims: AIA G706.

[ ] Contractor's Affidavit of Release of Liens: AIA G706A with:

[ ] Separate AIA G706A for subcontractors, suppliers, and others with lien rights against the property of owner, together with a list of those parties.

[ ] Consent of Surety to Final Payment: AIA G707.

Retainage reduction will not be considered until all items indicated on the above checklist are received in accordance with Section 017700 – Closeout Procedures.

END OF SECTION

SECTION 01 78 36 – WARRANTIES

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
   1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
   2. Division 1 Section "Closeout Procedures" specifies contract closeout procedures.
   3. Divisions 3 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.
   4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

1.2 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.

The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. Submit written warranties to the Architect and Construction Manager prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the architect.
   1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect and Construction Manager within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect and Construction Manager, for approval prior to final execution.
   1. Refer to Divisions 3 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. **Warranties must be job-specific from the manufacturer and**

reference this project. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
   2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor. Three hardcopy binders required, and 2 electronic copies in owner preferred format.
   3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.

B. Related Sections:

1. Section 033600 "Polished Concrete" for general building applications of specially finished formed concrete.
2. Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 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.

1.3 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures 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

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spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturers.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Fiber reinforcement.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

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2. 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.

3. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

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. 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.

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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 (19 by 19 mm), 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.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

D. Deformed-Steel Wire: ASTM A 496/A 496M.

E. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch (300-mm) wire length.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

H. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

I. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

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2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," 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 steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 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, gray. Supplement with the following:

a. Fly Ash: ASTM C 618,Class F or C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. At concrete slabs, provide Vapor Lock 20/20 Admixture by Specialty Products Group.

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B. Air-Entraining Admixture: ASTM C 260.

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

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. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
b. Cortec Corporation; MCI- [2000] [2005NS].
c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
d. Sika Corporation; FerroGard 901.

2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

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. Greenstreak.
b. Williams Products, Inc.

2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) nontapered.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints;

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resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

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. JP Specialties, Inc.; Earth Shield TPE-Rubber.
   b. Vinylex Corp.; PetroStop.
   c. WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.

2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.

C. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

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. BoMetals, Inc.
   b. Greenstreak.
   c. Paul Murphy Plastics Company.
   d. Vinylex Corp.

2. Profile: [Flat, dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick; nontapered.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

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. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
   b. CETCO; Volclay Waterstop-RX.
   c. Concrete Sealants Inc.; Conseal CS-231.
   d. Greenstreak; Swellstop.
   e. Henry Company, Sealants Division; Hydro-Flex.
   f. JP Specialties, Inc.; Earth Shield Type 20.

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

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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. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
   b. Greenstreak; Hydrotite.
   c. Vinylex Corp.; Swellseal.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
   b. Fortifiber Building Systems Group; Moistop Ultra 15.
   c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
   d. Insulation Solutions, Inc.; Viper VaporCheck 16.
   e. Meadows, W. R., Inc.; Perminator 15 mil.
   f. Raven Industries Inc.; Vapor Block 15.
   g. Reef Industries, Inc.; Griffolyn 15 mil Green.
   h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
   b. BASF Construction Chemicals - Building Systems; Confilm.
   c. ChemMasters; SprayFilm.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; Vapor-Aid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation; SikaFilm.

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o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

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. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec by Dayton Superior; Cure and Seal WB.
e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
g. Edoco by Dayton Superior; Spartan Cote WB II.
h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
j. Lambert Corporation; Glazecote Sealer-20.
k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
l. Meadows, W. R., Inc.; Vocomp-20.
m. Metalcrete Industries; Metcure.
n. Nox-Crete Products Group; Cure & Seal 150E.
o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
p. TK Products, Division of Sierra Corporation; TK-2519 WB.
q. Vexcon Chemicals, Inc.; Starseal 309.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

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C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) 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 (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface 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 topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

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2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Fly Ash: 25 percent.
3. Combined Fly Ash and Pozzolan: 25 percent.
4. Ground Granulated Blast-Furnace Slag: 50 percent.
5. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
6. Silica Fume: 10 percent.
7. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
8. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.

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3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, 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.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time,

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quantity, and amount of water added. Record approximate location of final deposit in structure.

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 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 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.

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.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. 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. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

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K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. 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 rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive 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. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. 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.

C. 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.

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3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.5 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 that would reduce bond to concrete.

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. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement 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.

3.6 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 keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

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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.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

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B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

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 and Structural Engineer.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. 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, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

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E. 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 average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
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 mixture designs.

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

1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist 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 defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

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

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

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

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

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement

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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 ACI 302.1R recommendations 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 darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

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a. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated, where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate or aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the 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 from 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.

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3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days 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 (300-mm) 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 (300 mm), 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 certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to

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heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

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 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

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3.14 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 **one** month(s). 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 semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 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 (1.18-mm) 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 to solid concrete. Limit cut depth to 3/4 inch (19 mm). 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.

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1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) 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 (6 mm) 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 (25 mm) 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 a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture 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 (25 mm) 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.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.

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3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: 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 mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; 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.
5. Compression Test Specimens: ASTM C 31/C 31M.

   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. 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.

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8. Strength of each concrete mixture 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 (3.4 MPa).
9. 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 mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. 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.
11. 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/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

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SECTION 033600 - POLISHED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparation of concrete flooring for application of liquid hardener/sealer.
2. Application of liquid hardener/sealer.
3. Polishing concrete to desired finish level.

1.2 SUBMITTALS

A. Product Data: For each type of material and accessory indicated.

B. Samples for Initial Selection: Manufacturer's color plates showing the full range of colors and patterns available.

C. Qualification Data: For Installer.

D. Maintenance Data: To include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer shall be certified in writing by manufacturer of specified polished concrete system to install their products.
2. Installer shall have 5 years experience, completed polished concrete installations similar in material, design, and extent to that indicated for this Project, and shall submit a record of successful in-service performance.

B. Source Limitations for Products: Provide only those products approved and/or provided by manufacturer of polished concrete system as specified.

C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Execute polished concrete mockup in location directed by Architect, minimum 5' x 5' in size.
2. Reprepare mock-up as required to obtain Architect's approval.
3. Protect mock-up during execution of polished concrete flooring.
4. Remove mock-up upon completion and acceptance of installed polished concrete flooring in building.

D. Preinstallation Conference: Conduct conference at Project site with all affected parties.

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1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer’s requirements and Division 03 “Cast-In-Place Concrete” section.

1. Concrete shall be cured a minimum of 45 days prior to application of concrete polishing system.

1.6 WARRANTY

A. Provide system manufacturer’s 10-year product and labor warranty covering entire installed system.

PART 2 - PRODUCTS

2.1 LIQUID HARDENER/SEALER

A. Densifier, Hardener and Sealer: Water-based sodium silicate “RetroPlate 99” manufactured by Advanced Floor Products, Inc.

1. Provide Level 1 hard shell satin finish.
2. Finish shall produce minimum 0.60 Static Coefficient of Friction as determined by testing identical products per ASTM C 1028.
3. Material shall have zero VOC’s.

B. Dyes: Provided by Retroplate; color as selected by Architect.

C. Grinding/Polishing Equipment: All machinery shall be approved for use by Advanced Floor Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with

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installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean and/or mechanically abrade or grind substrates in accordance with polished flooring material manufacturer's recommendations to produce clean, dry, and neutral substrate for system application.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written recommendations for application of polished concrete system.

B. Apply sealer/hardener to concrete including colored dye in accordance with manufacturer's directions. Finish to match approved samples.

3.4 CLEANING AND PROTECTING

A. Clean in accordance with manufacturer's directions..

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure polished concrete is without damage or deterioration at time of Substantial Completion.

END OF SECTION 033600

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SECTION 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast structural concrete.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for placing connection anchors in concrete.
2. Section 042000 "Unit Masonry" for inserts or anchorages required for precast concrete slab connections.
3. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
4. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.
5. Section 076200 "Sheet Metal Flashing and Trim" for flashing receivers and reglets.
6. Section 078413 "Penetration Firestopping" for joint-filler materials for fire-resistance-rated construction.
7. Section 079200 "Joint Sealants" for elastomeric joint sealants and sealant backings.

1.2 DEFINITION

A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Architect.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

C. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated on the drawings:

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1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318 (ACI 318M).

    a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 to plus 120 deg F (minus 10 to plus 67 deg C).

2. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

1.4 ACTION SUBMITTALS

A. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

B. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.

1. Indicate joints, reveals, and extent and location of each surface finish.
2. Indicate separate face and backup mixture locations and thicknesses.
3. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
4. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
6. Include and locate openings larger than by 10 inches (250 mm).
7. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
8. Indicate relationship of precast structural concrete units to adjacent materials.
9. Indicate locations and details of brick units, including corner units and special shapes, and joint treatment.
10. Indicate locations and details of stone facings, anchors, and joint widths.
11. Indicate estimated camber for precast floor slabs with concrete toppings.
12. Indicate shim sizes and grouting sequence.
13. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

C. Samples:

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1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).

    a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

2. Samples for each thin- or half-brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.

    a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
    b. Grout Samples for Verification: Showing color and texture of joint treatment.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.
6. Brick units and accessories.
7. Stone anchors and accessories.

D. Source quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

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1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:
   a. Group CA, Category C2A - Prestressed Hollowcore and Repetitively Produced Products.

B. Installer Qualifications: An experienced precast concrete erector who, before erection of precast concrete, has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in Category S1 - Simple Structural Systems and who produces an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."

C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to the following:

   1. AWS D1.1/D.1.1M, "Structural Welding Code - Steel."
   2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

F. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets the prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies," and is acceptable to authorities having jurisdiction.

G. Sample Panels: After sample approval and before fabricating precast structural concrete units with architectural finish, produce a minimum of 2 sample panels approximately 16 sq. ft. (1.5 sq. m) in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

   1. Locate panels where indicated or, if not indicated, as directed by Architect.
   2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
   3. After approval of repair technique, maintain one sample panel at fabricator's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
   4. Demolish and remove sample panels when directed.

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5. Build mockup as indicated on Drawings including sealants and precast structural concrete units with an architectural finish complete with anchors, connections, flashings, and joint fillers.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.

D. Lift and support units only at designated points shown on Shop Drawings.

1.8 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Oldcastle Precast Building Systems.

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2.2 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

   1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.4 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, 7-wire or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, 7-wire, low-relaxation strand.

B. Unbonded Post-Tensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.

   1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.6 and sheath with polypropylene tendon sheathing complying with ACI 423.6. Include anchorage devices and coupler assemblies.

C. Post-Tensioning Bars: ASTM A 722, uncoated high-strength steel bar.

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2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin Admixture: ASTM C 618, Class N.
3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate unless otherwise approved by Architect.

D. Lightweight Aggregates: Except as modified by PCI MNL 116, ASTM C 330, with absorption less than 11 percent.

E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

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6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M.

I. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.6 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283/A 283M.

D. Malleable-Iron Castings: ASTM A 47/A 47M.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M) or ASTM A 490 (ASTM A 490M,), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).

1. Do not zinc coat ASTM A 490 (ASTM A 490M) bolts.

L. Welding Electrodes: Comply with AWS standards.

M. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

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2.7 STAINLESS-STEEL CONNECTION MATERIALS

A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.

B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

C. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 116.

2.8 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test 1 specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless- or mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or 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.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

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C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash to 25 percent replacement of portland cement by weight and granulated blast-furnace slag to 40 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

   1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.

F. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:

   1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
   2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

I. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

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2.11 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered or radiused.

2.12 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.

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2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Increase cover requirements according to ACI 318 (ACI 318M) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
5. Protect strand ends and anchorages with a minimum of 1-inch- (25-mm-) thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

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J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

L. Comply with ACI 306.1 procedures for cold-weather concrete placement.

M. Comply with PCI MNL 116 procedures for hot-weather concrete placement.

N. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.

O. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

P. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.13 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.14 COMMERCIAL FINISHES

A. Commercial Grade: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).

B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color

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variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.

1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.

1. Test and inspect self-consolidating concrete according to PCI TR-6.

C. Strength of precast structural concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
2. Cores will be tested in an air-dry condition or, if units will be wet under service conditions, test cores after immersion in water in a wet condition.
3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:

   a. Project identification name and number.
   b. Date when tests were performed.
   c. Name of precast concrete fabricator.
   d. Name of concrete testing agency.
   e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

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E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place, building structural framing has attained minimum allowable design compressive strength or until supporting steel or other structure is complete.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connection.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

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C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of the Architect.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
4. Remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

H. Grouting: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.

1. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
6. Keep grouted joints damp for not less than 24 hours after initial set.

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3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Erection of precast structural concrete members.
2. Reinforcement installation
3. Other items specified in the project Statement of Special Inspections>.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Field welds will be visually inspected and nondestructive tested according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.5 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units has not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

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C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

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SECTION 035300 - CONCRETE TOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emery-aggregate concrete floor topping.

B. Related Sections:

1. Section 093000 "Tiling" for medium-set and thickset mortar beds for tile.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for concrete floor topping.

1.4 QUALITY ASSURANCE

A. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Build mockups approximately 100 sq. ft. (9.3 sq. m) in the location indicated or, if not indicated, as directed by Architect.
2. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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, mixing with other components, and application.

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B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.

1. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 and 86 deg F (10 and 30 deg C).

B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR TOPPINGS

A. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.

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. Anti-Hydro International, Inc.; A-H Emery A-1 Premix.
b. CONSPEC, by Dayton Superior; Conspec Emery Topping.
c. Dayton Superior Corporation; Emery Tuff Top.
d. L&M Construction Chemicals, Inc.; Emerytop 400.
e. Metalcrete Industries; Met-Top E.
f. US Concrete Materials, LLC; Florundum Emery 1-T Premix.

2. Compressive Strength (28 Days): 10,000 psi (69 MPa] ASTM C 109/C 109M.

2.2 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. (305 g/sq. m) when dry.

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C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 25 percent solids content, minimum.

2.3 RELATED MATERIALS

A. Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 per ASTM D 2240.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

C. Portland Cement: ASTM C 150, Type I or II.

D. Sand: ASTM C 404, fine aggregate passing No. 16 (1.18-mm) sieve.

E. Water: Potable.

F. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

G. Epoxy Adhesive: ASTM C 881/C 881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.4 MIXING

A. Bonding Slurry: Mix portland cement with water to a thick paint consistency.

B. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.

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B. Verify that base concrete slabs comply with scratch finish requirements specified in Section 033000 "Cast-in-Place Concrete."

C. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface, unless otherwise indicated.
2. Terminate full-width, joint-filler strips 1/2 inch (13 mm) below topping surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.3 FLOOR TOPPING APPLICATION

A. Start floor topping application in presence of manufacturer's technical representative.

B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Section 033000 "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.

C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.

D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.

E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.

1. Screed surface with a straightedge and strike off to correct elevations.
2. Slope surfaces uniformly where indicated.
3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

F. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.

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1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.

    a. Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and measure within 24 hours according to ASTM E 1155 (ASTM E 1155M) for a randomly trafficked floor surface.
    b. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot- (3-m-) long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).

G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.

1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.

H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.

1. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

3.4 PROTECTING AND CURING

A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.

C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:

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1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with water, continuous water-fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) 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 (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.5 JOINT FILLING

A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.6 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:

1. Sample Sets: At point of placement, a set of 3 molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft. (93 sq. m), plus 1 set of samples for each subsequent 5000 sq. ft. (464 sq. m) of topping, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109/C 109M for compliance with compressive-strength requirements.

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2. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
3. Concrete floor topping shall be tested for compliance with surface flatness and levelness tolerances.

C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 035300

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SECTION 042000 – UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units. (CMU)
2. Architectural concrete masonry units (ACMU)
3. Mortar and grout, including mortar for cast stone.
4. Masonry joint reinforcement.
5. Reinforcing steel
6. Ties and anchors.
7. Prefabricated masonry lintels.
8. Insulating inserts in CMU cores.
9. Miscellaneous masonry accessories.

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

1. Mortar for cast stone veneer units and trim installed under Division 04 Section “Cast Stone”.

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

1. Hollow-metal frames in unit masonry openings, furnished under Division 08 Section "Hollow Metal Doors and Frames."

1.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops a net-area compressive strength of 1,900 psi as indicated at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602

1.3 ACTION SUBMITTALS

A. Product Data: For each different masonry unit, mortar material, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:

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1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples for Initial Selection: For the following:

1. Colored mortar samples, for each mortar color required, showing the full range expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate type and amount of colorant used.
2. Architectural concrete masonry units, demonstrating full range of available colors and textures.
3. Weep holes/vents in color to match mortar color

D. Samples for Verification: For the following:

1. Full-size units for architectural concrete masonry units, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar samples, for each mortar color required, showing the full range expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate type and amount of colorant used.

1.4 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.
2. Mortar complying with property requirements of ASTM C 270.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

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a. Include data on material properties.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each type and size of joint reinforcement.
4. Each type and size of anchor, tie, and metal accessory.
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.

E. 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 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. 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 Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Masonry Standard: Comply with requirements of "Specifications for Masonry Structures, ACI 530.1/ASCE 6/TSM 602" published by the American Concrete Institute, except when more stringent requirements are specified and as modified by the requirements of these Contract Documents.

1. Revise ACI 530.1/ASCE 6/TSM 602 to exclude Article 1.5; Subparagraphs 1.1 C.1 through 4., Subparagraphs 3.3 E.1 through 5.

B. Installer Qualifications: Engage an experienced installer who has 10 years experience as a journeymen mason, and who has completed masonry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1. A minimum of one skilled journeyman mason shall be present at all times during masonry erection and shall personally direct the work.

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C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

G. Mockup: Before installing architectural concrete unit masonry, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockup in the location as directed by Architect.
2. Build mock-up of new masonry construction containing the following types of masonry approximately 4’-0” long by 8’-0” high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches (400 mm) long in the mockup.
   a. Typical exterior masonry-veneer ACMU wall, complete with back-up, reinforcing/ties, insulation, flashing, and other accessories.

3. Clean one-half of exposed faces of mockup with masonry cleaner.
4. Protect accepted mockup from the elements with weather-resistant membrane.
5. Approval of mockup is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockup is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing

6. Final approval of masonry unit color and texture and mortar color and texture will be made based on acceptance of mock-up.
7. Remove and reconstruct mockup as required to obtain Architect’s approval.
8. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of 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.

B. 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 coverings spread 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 near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. 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 Part 1.8 C. of ACI 530.1/ASCE 6/TMS 602.

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

D. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

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E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Comply with cold-weather construction requirements contained in Part 1.8 D. of ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners that are exposed to view, unless otherwise indicated.

B. Concrete Masonry Units (CMU): ASTM C 90 with minimum average net-area compressive strength of 1900 psi; normal weight; and as follows:

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1. Size: Manufactured to the following dimensions: 16 inches by 8 inches nominal; 7-5/8 inches by 15-5/8 inches actual; by thickness indicated.
2. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
3. Provide U.L. classified units for rated walls, or units meeting the fire resistance ratings by equivalent concrete masonry thickness.

C. Architectural Concrete Masonry Units (ACMU): ASTM C 90 with minimum average net-area compressive strength of 2800 psi; normal weight, unless otherwise indicated; with mix compositions of white or gray ASTM C 150 Portland cement in combination with ASTM C 33 aggregates from full range of whites, granites, integral water repellant admixture, and color pigmentation ratio not to exceed 10-percent, all as required for color matrix and aggregates specified. Provide units as follows:

1. Size: 8" x 16" x depth indicated.
2. Color: As selected by Architect.
3. Surface Texture: Ground face.
4. Surface Finish: Factory-applied heat-treated acrylic or water-based sealer finish..
5. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength; of type approved by the ACMU manufacturer.

2.2 MORTAR AND GROUT MATERIALS

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A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

1. For concrete block work, provide natural color cement.
2. For cast stone and ACMU work provide natural color or white cement as required to produce required mortar colors.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

D. Masonry Cement: Not permitted.

E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

1. For colored mortar, provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar colors.

F. Aggregate for Grout: ASTM C 404.

G. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars

H. Water: Potable.

2.1 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.2 MASONRY JOINT REINFORCEMENT

A. General: ASTM A 951 and as follows:

1. Mill galvanized, carbon-steel wire for interior walls, unless noted below.
2. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide ladder type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

2.3 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

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B. Mill Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641 (ASTM A 641M), Class 1 coating.

C. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

D. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153

E. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 JOINT STABILIZATION ANCHORS

A. General: Contractor's option to select between the two types listed below.

B. Three-piece assemblies allowing movement at expansion, contraction or isolation joint while maintaining wall alignment in direction normal to the movement. Two 3/16-inch (4.8-mm) diameter wire rods with plastic sleeves separating two 1/32-inch (0.8-mm) sheet metal sleeves for embedding completely in mortar, zinc plated. Provide one of the following products, or equivalent:

1. Hohmann & Barnard “Slip-Set Stabilizer”.
2. Wire Bond “1700 Control Joint Anchor”

C. Partition Top Anchors: Galvanized 3/8-inch (9-mm) by 6 inches (150 mm) steel dowel vertically welded to a 2-inch (50-mm) by 5-inch (125-mm) steel plate with slotted holes for mounting to the underside of beams or deck, and a plastic sleeve with compressible filler to prevent dowel from bonding with mortar. Provide one of the following products, or equivalent:

1. Hohmann & Barnard “PTA-420 with tube”.
2. Wire Bond “PTA 4301”
3. Heckman Building Products “419”

2.5 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing or insulation to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

B. Screw-Attached, Masonry-Veneer Anchors for Metal Stud Back-up Construction With No Insulation in Cavity: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

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1. Anchor Section: Sheet metal plate 5-1/2" long with 9/32" diameter screw holes top and bottom; with projecting portion providing a 3" vertical adjustability for wire tie section.
2. Wire Tie Section: Rectangular- shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
3. Fabricate sheet metal anchor section from 14 gauge thick, steel sheet, hot-dip galvanized after fabrication.
4. Fabricate wire tie sections from 3/16 inch- diameter, hot-dip galvanized steel wire.
5. Basis of Design Product: DW-10HS; Hohmann & Barnard, Inc. or equal product by one of the following:
   a. Wire-Bond.
   b. Heckmann Building Products

C. Stainless-Steel Drill Screws for Steel Studs: Either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than three exposed threads.

2.6 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.

B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.
2. Type: Expansion anchors.
3. Corrosion Protection(Indoor): Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
4. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
5. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
6. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

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A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated, or required.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
2. Product: Dur-O-Wal #D/A 2001 or equal.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe.

1. Color: Match mortar color.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
   a. WeepVent by Mortar Net Solutions.
   b. CavClear Weep Vents.
   c. Weep Mesh by Advanced Building Products

E. Cavity Drainage Material: 3/4-inch- (50-mm-) thick, reticulated, nonabsorbent mesh, made from polyethylene strands with 90% open plastic mesh configuration.

1. Use in cavities with masonry back up and with less than 1-1/8" clear cavity only.
2. Basis of Design Product: CavClear Masonry Mat manufactured by CavClear, or equivalent.

F. Insulation Inserts in CMU Cores: Inserts fabricated from flame-retardant treated expandable polystyrene meeting ASTM C 578, Type 1 and sized to fit cores in CMU of sizes indicated on Drawings. Inserts shall be preinstalled at the block plant prior to delivery on the job site.

1. Basis of Design Product: KORFIL by CBIS or equal.

2.8 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

B. Proprietary Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

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1. Products for Cleaning Unit Masonry: Subject to compliance with requirements, provide one of the following products or equivalent products from alternative manufacturers:
   a. Cleaners for Architectural Concrete Masonry Units: Sure Klean Light Duty Concrete Cleaner by ProSoCo, Inc.

2. Alternative Manufacturers: Alternative manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
   a. Diedrich Technologies Inc
   b. Dominion Restoration, Inc.
   c. EaCo Chem, Inc.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

   1. Do not use calcium chloride in mortar or grout.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Colored Mortar for Cast Stone and ACMU Work: Produce mortar of color specified, and to match approved mock-up by using selected ingredients. Do not alter specified proportions without Architect's approval.

   1. Use naturally colored aggregates to produce required mortar color to greatest extent possible, before adding pigments.
   2. Pigments: Where mortar pigments are used, do not exceed a pigment-to-cement ratio of 1:10 by weight.
   3. Color: As selected by Architect for each masonry material and application.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

   1. Limit cementitious materials in mortar to portland cement and lime.
   2. For exterior above-grade load-bearing and exterior above-grade non-load-bearing walls, interior load-bearing walls, parapet walls, and where indicated, use Type N.
   3. For interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
   4. For cast stone units, use Type N.

E. Grout for Unit Masonry: Comply with ASTM C 476.

   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

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2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. For cold-weather construction comply with requirements contained in ACI-530/ASCE5/TMS 402.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, un-chipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

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B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, the following tolerances will apply.

1. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
2. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
4. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out 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.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated below; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. For concrete block work, lay in running bond pattern
2. For ACMU, lay in bond pattern indicated on Drawings.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth.

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Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated, and at all exterior wall locations.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

J. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 07 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.6 CAVITIES

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A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
   a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally, with not less than 1 anchor for each 1.77 sq. ft. (0.16 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around the perimeter.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install vertical control and expansion joints at one side of all doorways and at wall locations maximum 25 ft. o.c., and where indicated. Build-in related items as

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masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry with preformed control-joint gaskets designed to fit standard sash block.

C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.10 LINTELS

A. Install steel lintels where indicated. Steel lintels are supplied under Division 05 Section “Metal Fabrications.”

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units 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

C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND VENTS

A. Install weep holes in the head joints in exterior wythes of the first course of masonry and as follows:

1. Use mesh weep vents to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c.
3. Place cavity drainage material in cavities.

B. Install vents in vertical head joints at the top of each continuous cavity spaced at 24 inches o.c.. Use mesh weep vents to form vents.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. General: Provide reinforced unit masonry walls at all walls as indicated.

B. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar

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and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

C. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

D. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height

3.13 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified certified testing agency to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 . Test mortar for mortar air content and compressive strength.

D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.14 REPAIRING, POINTING, 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.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry using cleaning materials specified in Part 2 as follows:

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1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

END OF SECTION 042000

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SECTION 047200 – CAST STONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cast stone copings, trim, caps, and other shapes indicated on drawings.
2. Cast stone panels.
3. Stainless steel support and retention connections for cast stone, including all ties, anchors, and necessary shims to supporting structure.
4. Engineered anchoring designs and connections, by a professional engineer employed by the Contractor.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for mortar and grout, and miscellaneous accessories.

1.2 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

B. Arris: The sharp edge of a Cast Stone Unit.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, design, fabricate and erect the precast units and supports to withstand loads from winds, gravity, seismic, structural movement including movement thermally induced, and to resist in-service use conditions that the units will experience, including exposure to the weather, without failure.

1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member.
2. Design connection of precast units to structural backup. Refer to structural drawings and loads specified herein for minimum connection requirements.

B. Design Loads: Basic design loads include live loads, wind loads, and seismic load, in addition to the dead load.

1. Comply with requirements indicated on structural drawings.

1.4 ACTION SUBMITTALS

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A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.

B. Design Mixes: For each different mix.

C. Shop Drawings: Prepared by or under supervision of a qualified professional engineer. Detail fabrication and installation of cast stone units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement, and lifting devices necessary for handling and erection.

1. Include building elevations showing layout of units and locations of joints and anchors
2. Indicate locations and details of anchorage devices to be embedded in other construction.
3. Include erection procedure for precast units, sequence of erection, and erection tolerances.
4. Provide complete design calculations, including loads imposed on structure, stamped and signed by qualified professional engineer.

D. Samples for Initial Selection: For colored mortar, showing the full range of colors available.

E. Samples for Verification:

1. For each mortar color required, showing the full range expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate type and amount of colorant used.
2. For each color and texture of cast stone required, 10-inches (250 mm) square in size.

F. Full-Size Samples: For each type of cast stone unit required. Make available for Architect's review at Project site before installing cast stone.

1. Approved Samples may be installed in the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Fabricator and Professional Engineer.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of cast stone with requirements indicated.

C. Certification that the materials incorporated in this Work are free from hazardous contaminates.

1.6 QUALITY ASSURANCE

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A. Fabricator Qualifications: A firm experienced in manufacturing cast stone units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.

1. Fabricator shall assume responsibility for engineering cast stone units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Fabricator is a producing member of the Cast Stone Institute

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the location of the Project and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cast stone units that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Mockups: Before installing cast stone panels, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockup in the locations as directed by Architect.
2. Build mock-up approximately 4’-0” long by 4’-0” high by full thickness, including face and backup wythes and accessories. Include a sealant filled joint at least 16 inches (400 mm) long in the mockup.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color and texture of cast stone; relationship of mortar and sealant colors to cast stone colors; tooling of joints; and aesthetic qualities of workmanship.
5. Remove and reconstruct mockups as required to obtain Architect’s approval.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship cast stone units in suitable packs or pallets.

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1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

B. Store installation materials on elevated platforms, under cover, and in a dry location.

C. Store mortar aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.8 COORDINATION

A. Coordinate production and delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.

B. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Provide products of Stone Legends, Inc. or equal products manufactured by one of the following

1. Arriscraft
2. American ArtStone.
3. Corinthian Cast Stone
4. Continental Cast Stone Manufacturing, Inc.

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures.

D. Fine Aggregates: Manufactured or natural sands complying with ASTM C 33, gradation as needed to produce required textures.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

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F. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

2.3 STAINLESS-STEEL SUPPORT AND CONNECTION MATERIALS

A. Anchors: Stainless steel, ASTM A 666, Type 304, of temper and diameter required to support loads without exceeding allowable design stresses.

B. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install cast stone units.

2.4 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

B. Physical Properties:

1. Compressive Strength: Minimum 6,500 psi when tested per ASTM C 1194.
2. Absorption: Maximum 6% when tester per ASTM C 1195.

C. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of material. Minimum coverage shall be twice the diameter of the bars.

1. Area of reinforcement in panels greater than 12" wide shall be not less than 1/4 percent of the cross section area when steel is specified.

D. Fabrication Method: Use a Vibrant-Tamp placement method or machine manufacture using a zero slump mixture to achieve desired appearance and physical properties.

E. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.

F. Cure and finish units as follows:

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1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
2. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.
3. Acid etch units to remove cement film from surfaces indicated to be finished.

G. Color and Texture: Exposed surfaces shall exhibit a fine-grained texture similar to natural stone; no bug-holes or air voids shall be permitted.

1. Color and Texture: Simulate buff limestone, in smooth texture, manufactured by Stone Legends, Inc., or equal.

H. Unit Dimensions:

1. Panels: 2” thick, in face dimensions as indicated on Drawings.
2. Trim Units: Dimensions and shapes as indicated on Drawings.

2.5 MORTAR MATERIALS

A. Provide mortar materials that comply with Division 04 Section "Unit Masonry."

2.6 ACCESSORIES

A. Anchors for Cast Stone Trim: Units fabricated with tabs or dowels designed to engage kerfs or holes in cast stone trim units and holes for fastening to framing of type as indicated, size as required for project conditions, fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, 1/2-inch (12-mm) diameter.

C. Cast Stone Cleaner: Sure Kleen #600 by ProSoCo Products Inc., or equal.

2.7 MORTAR MIXES

A. Provide ASTM C 270, Type N colored mortar. Comply with requirements in Division 04 Section "Unit Masonry" for mortar mixes.

2.8 SOURCE QUALITY CONTROL

A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.

1. Include testing for freezing and thawing resistance.

PART 3 - EXECUTION

3.1 EXAMINATION

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A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with Cast Stone Institute recommendation for installation of cast stone units.

B. Set cast stone as indicated on Contract Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

C. Anchor cast stone panels in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.

D. Drench units with clear water just before setting.

E. Set units in full bed of mortar with full head joints, unless otherwise indicated. Build anchors and ties into mortar joints as units are set.

1. Fill dowel holes and anchor slots with mortar.
2. Fill collar joint solid as units are set.
3. Build concealed flashing into mortar joints as units are set.
4. Leave head joints open in coping and other units with exposed horizontal surfaces. Keep joints clear of mortar, and rake out to receive sealant.

F. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

G. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

H. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

I. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Sealing joints is specified in Division 07 Section "Joint Sealants."
2. Keep joints free of mortar and other rigid materials.

3.3 INSTALLATION TOLERANCES

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A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean cast stone in conformance cleaner manufacturer’s directions.

END OF SECTION 047200

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SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections:

1. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
3. Section 055000 "Metal Fabrications" for other metal items not defined as structural steel.
4.
5. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
2. Welded built-up members with plates thicker than 2 inches (50 mm).
3. Column base plates thicker than 2 inches (50 mm).

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

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E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame, braced frame, and shear walls.

1.4 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.
8. 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. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

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1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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1.7 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.

1.8 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.

B. Channels, Angles-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

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2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

   1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

   1. Finish: Plain.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

   1. Configuration: Hooked.
   2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
   5. Finish: Plain.

E. Threaded Rods: ASTM A 36/A 36M.

   1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
   2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
   3. Finish: Plain.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

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2.3 PRIMER

A. Primer: Comply with Section 099100 "Interior Painting."

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

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

2.5 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 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. 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/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

F. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to

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frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.
2. Baseplate 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.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 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.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

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.

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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.

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.

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F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. 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.

B. Weld Connections: Comply with AWS D1.1/D1.1M[and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and 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/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.

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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.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with 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: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting."

END OF SECTION 051200

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SECTION 052200 - Hambro® MD2000

PART 1 - GENERAL

1.1 SCOPE: The contractor shall:

A. Furnish all labor, materials, equipment, supervision and services necessary for and incidental to the fabrication and installation of the Hambro ® Composite Floor System in accordance with these specifications and applicable drawings. Hambro ® Steel joists and metal deck shall be manufactured and marketed by Canam Hambro® or their authorized representatives.

B. Fully coordinate the Hambro ® joists with the other structural mechanical electrical and architectural components of the building.

PART 2 - TYPICAL SPECIFICATION

2.1 CODES

All fabrication shall be in strict accordance with the Hambro ® Shop Standard Practice, using steel conforming to ASTM Standards. Structural, fire and sound characteristics shall meet the requirements of the Building Officials and Code Administrators International Inc. (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress (SBCC), and the United States Department of Housing and Urban Development, Federal Housing Administration (HUD/FHA), South Florida Building Code (as applicable).

2.2 DESIGN

Flexural design shall be by the Ultimate Strength method and as described in the Hambro ® literature. The slab shall be designed in accordance with the Building Code Requirements for Reinforced Concrete (ACI 318-71); the top chord shall be designed in accordance with the American Iron and Steel Institute Specification for the Design of Cold-Formed Steel Structural Members; and the webs shall be designed for loading in accordance with the Steel Joist Institute.

2.3 QUALIFICATIONS

A. All welding materials and methods used for fabrication shall be in accordance with the requirements of the Hambro® Shop Standard Practice.

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B. All field welders shall be certified, qualified operators for the materials and methods being used, except that Hambro ® joist repairs or modifications that may be required may be done by factory approved personnel.

2.4 DRAWINGS

A. Submit detailed shop drawings to the General Contractor for approval showing material lists, mark numbers, types, locations, loadings and spacing of all joists and accessories. Contract drawing notes relative to the Hambro® System shall be considered a part of this specification as though fully set forth herein.

B. Shop tickets prepared only from customer Approved/Field-Use shop drawings shall be used for fabrication.

C. Figured dimensions only shall be used; scaling drawings shall not be permitted.

2.5 HANDLING AND STORAGE

Care shall be exercised at all times to avoid damage to Hambro® joists through careless handling during unloading storing and erecting.

PART 3 - PRODUCTS

3.1 MATERIALS

A. Hambro® joists
1. All composite joists shall be fabricated by Canam Hambro® in accordance with Section 2.1 and 2.2 of these Specifications.
2. Top chord member shall act as a continuous shear connector of cold rolled steel, minimum 13 gauge with Fy = 50,000 p.s.i. minimum
3. Bottom chord member shall consist of either hot or cold rolled angles with Fy = 50,000 p.s.i. minimum.
4. Web members designed to equal or exceed Steel Joist Institute (SJI) specifications shall consist of minimum 7/16 diameter hot rolled bars, some of which are continuous, bent at top chord joist locations with Fy = 44,000 p.s.i. minimum.
5. Standard bearing shoes shall be angle shape 4” x 1- 3/4” x _” x 5” wide unless otherwise noted.
6. All composite joists shall be shop primer painted with a rust inhibitive primer.

B. Metal deck shall be 1-1/2” (min 9/16”) deep, 24 gauge (min 28ga), type B, uncoated, light zinc or galvanized metal form deck. Metal deck shall be fastened or welded to Hambro® joist deck support angles every 18” (max 24”) along S-shaped top chord.

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C. Slab reinforcement shall be minimum 6 x 6 W2.0 x W2.0 welded wire fabric. with Fy = 60,000 p.s.i. minimum unless otherwise required by structural engineer.

D. Concrete:
   1. Minimum ultimate compressive strength f c = 3.000 p.s.i. at 28 days
   2. Standard weight i.e. 145 psf
   3. Maximum size coarse aggregate: 3/4”

3.2 FABRICATION

A. Fabrication shall be in accordance with the Hambro ® Shop Standard Practice.

B. The joist top chord shall be fabricated to allow for 1" embedment into the concrete slab.

C. After installation permissible Hambro joist sweep shall be 1” in 20’

D. Hambro ® joists shall be fabricated with approximately the following cambers:

10’-20’ span ..... 0 to 1/2”
20’-30’ span .....1/2” to 3/4"
30’-40’ span ..... 3/4" to 1”

3.3 QUALITY CONTROL

Joist shall be manufactured in a fabricator’s facility having a continuous quality control program and subjected to plant inspections by an approved independent agency. The inspection shall include checking of size, span, assembly and welds.

PART 4 - EXECUTION

4.1 ERECTION

A. Installation of the Hambro ® MD-2000 composite floor system shall be in accordance with the latest erection manual, approved shop drawings and any amendments which may be issued by the manufacturer.

B. All joists shall be erected in such a manner so that they are vertical, level and plumb and at the proper elevations. Any shimming that may be required shall be done with metal.

C. Special conditions requiring top and/or bottom bracing shall be shown on shop drawings prepared by supplier.

D. Welded Wire Fabric Lapping shall be in accordance with the provisions of ACI 318

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E. End anchorage - joist shoes shall be properly anchored or embedded as per engineer's or architect's drawings.

F. Concreting Practice
   1. Do not pour concrete in excess of the slab thickness stated on the shop drawings.
   2. Do not drop large bucket loads in concentrated areas over Hambro ® joists. Lightly vibrate concrete.
   3. Construction joints made parallel to the joists should be made midway between the joists but never closer than 6" to the top chord. Construction joints made perpendicular to the joists should be located over the supporting wall or beam.
   4. It is recommended that the following ACI publications be followed:
      a. ACI 301 - Specifications for Structural Concrete for Buildings.
      b. ACI 305 - Recommended Practice for Hot-Weather Concreting.
      c. ACI 306 - Recommended Practice for Cold-Weather Concreting.

G. Construction Loads
   1. Bundles of metal deck should not be placed on joist system but rather on supporting walls or beams.
   2. The joists are designed to resist the combined weight of the wet concrete (specified slab thickness), metal deck and a construction load of 20 PSF maximum.

H. Minimum joist bearing shall be as follows:
   1. Steel support: 2”
   2. Masonry, concrete and wood support: 3-1/2” bearing capacity of supporting units to comply with applied shoe end reaction, based on minimum

END OF SECTION 052200

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SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Noncomposite form deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. 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.

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D. Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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."

B. 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 ROOF DECK

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. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.

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6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: 0.0358 inch (0.91 mm).
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 NONCOMPOSITE FORM DECK

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. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Group.
10. Roof Deck, Inc.
11. Valley Joist; Subsidiary of EBSCO Industries, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

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1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) zinc coating.

2. Profile Depth: 9/16 inch (14 mm).
3. Design Uncoated-Steel Thickness: 0.0179 inch (0.45 mm).
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

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 indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. 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.

I. Galvanizing Repair Paint: ASTM A 780.

J. 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, 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.

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. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

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.

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.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.

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 36 inches (914 mm), and as follows:

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1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. 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.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. 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.

F. 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: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
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 half of the span or 36 inches (914 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

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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 or butted at Contractor's option.

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. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds 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.

3.6 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. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.
7. Roof trusses.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
3. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

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B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

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.

1.4 QUALITY ASSURANCE

A. 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.

B. 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."

1.5 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AllSteel & Gypsum Products, Inc.
2. California Expanded Metal Products Company.
3. ClarkWestern Building Systems, Inc.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Mfg., Inc.
6. Custom Stud Inc.

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7. Design Shapes in Steel.
8. Dietrich Metal Framing; a Worthington Industries Company.
9. Formetal Co. Inc. (The).
10. MarinoWARE.
11. Nuconsteel; a Nucor Company.
12. Olmar Supply, Inc.
13. Quail Run Building Materials, Inc.
14. SCAFCO Corporation.
15. Southeastern Stud & Components, Inc.
16. State Building Products, Inc.
17. Steel Construction Systems.
18. Steel Network, Inc. (The).
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products, Inc.
22. Telling Industries, LLC.
23. United Metal Products, Inc.
24. United Steel Manufacturing.

2.2 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-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
   b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
   d. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.
   e. Roof Rafter Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
   f. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
   g. Roof Trusses: Vertical deflection of 1/240 or 1” for snow/live loads and 1/180 or 1-1/2” total loads of the span. Horizontal deflection of 3/8” for snow/live loads and 1/2” for total loads.

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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 (67 deg C).
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 (25 mm).

5. Design exterior 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.
5. Roof trusses: AISU “Standard for Cold-Formed Steel Framing – Truss Design.”

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.

2.3 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: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).

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: G60 (Z180).

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2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: Use effective section properties for design.

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 (32 mm).

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: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: Use effective section properties for design.

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Top Flange Width: 1-1/2 inches (38 mm).
3. Section Properties: Use effective section properties for design.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: Use effective section properties for design.

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 (32 mm).

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C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AllSteel & Gypsum Products, Inc.
b. ClarkWestern Building Systems, Inc.
c. Dietrich Metal Framing; a Worthington Industries company.
d. MarinoWARE.
e. SCAFCO Corporation.
f. Steel Network, Inc. (The).
g. Steeler, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Use effective section properties for design.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel joists.
2. Flange Width: 1-1/4 inches (32 mm), minimum.

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2.7 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Use effective section properties for design.

2.8 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Use effective section properties for design.

2.9 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Use effective section properties for design.

2.10 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections.

2.11 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.

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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.

2.12 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.

2.13 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. 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.

C. 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.

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D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.14 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 (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) 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 (3 mm).

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.

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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 (6 mm) 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 (1.6 mm).

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.

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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 (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) 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: To match stud spacing.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) 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.

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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. 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 (150 mm) 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.

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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 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. Connect vertical deflection clips to infill studs and anchor to building structure.
3. 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 (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) 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.

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.

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3.6 JOIST INSTALLATION

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

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

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B. Truss Spacing: 16 inches.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

3.8 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.

3.9 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 SECTION 054000

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel ladder.
2. Steel stairs with concrete-filled treads.
3. Handrails and railings at stairs.
4. Handrails attached to walls adjacent to stairs.
5. Guardrails.
6. Support angles for elevator door sills.
7. Loose bearing and leveling plates.
8. Loose steel lintels.
9. Steel framing and supports for ceiling hung equipment.
10. Steel framing and supports for mechanical and electrical equipment.
11. Steel framing and supports for applications where framing and supports are not specified in other Sections.
12. Steel elevator sump pit gratings.
13. Cast iron wheel guards.
14. Manhole cover
15. Antenna mounting framing at exterior facade.
16. Metal downspout boots.
17. Structural steel door frames for garage doors.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal stairs, handrails and railings, guardrails, and ladders.

B. Structural Performance of Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance of Metal Stairs, Walkways and Platforms: Provide metal stairs, walkways and platforms capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs, walkways and platforms.

1. Treads and Platforms of Metal Stairs, and Walkways: Capable of withstanding a uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m) or a concentrated load of 300 lbf (1.33 kN) on an area of 4 sq. in. (25.8 sq. cm), whichever produces the greater stress.
2. Stair and Walkway Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.

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3. Limit deflection of treads, platforms, walkways and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

D. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
   b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
   b. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
   a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guards.

1.3 ACTION SUBMITTALS

A. Product Data: For all fabricated products including the following:

1. Gratings.
2. Paint products.
3. Grout.
4. Nonslip aggregates and nonslip-aggregate surface finishes
5. Ladders
6. Fabricated railing systems
7. Ships ladders

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: Sample of the following:

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1. 6" square piece of each type of bar grating.

1.4 INFORMATIONAL SUBMITTALS

A. Welding Certificates: Copies of certificates for welding procedures and personnel.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Delegated-Design Submittal: For stairs, handrails and railings, guardrails, and ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

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 installations of metal stairs, platforms, walkways, and handrails and railing systems that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.2, "Structural Welding Code--Aluminum."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Mockups: Build mockups of each type of handrail, railing and guardrail system to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Each mock-up shall consist of a typical panel including two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches (600 mm) in length.
2. Notify Architect seven days in advance of dates and times when mock-up will be constructed
3. Remove/dismantle and reprepare mock-up as required to obtain Architect's approval.
4. Approved mock-ups may be incorporated in the finished work.

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1.6 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

1.8 SEQUENCING AND SCHEDULING

A. Sequence and coordinate installation of wall handrails as follows:

1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
2. Mount handrails only on gypsum board assemblies reinforced to receive anchors, and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications 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.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads. For exterior installations and where indicated, provide pipe with hot-dip galvanized coating.

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D. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c.

1. Width of Channels: 1-5/8 inches (41 mm).
2. Depth of Channels: As indicated.
3. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
4. Finish: Unfinished.

E. Steel Bars for Gratings: ASTM A 36/A 36M.

F. Wire Rod for Grating Crossbars: (ASTM A 510M)

G. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

H. Gray-Iron Castings: ASTM A 48, Class 30 (ASTM A 48M, Class 200), unless another class is indicated or required by structural loads.

I. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

J. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded..

2.3 PAINT

A. Shop Primer for Interior Ferrous Metal: Modified oil-alkyd primer, Tnemec 88-559 or 10-1009, or equivalent. Primer shall be compatible with finish paint specified in Section 09900.

B. Shop Primer for Galvanized Ferrous Metal: Polyamide epoxy primer, Tnemec F.C. Typoxy Series 27, or equivalent. Primer shall be compatible with finish paint specified in Section 09900.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Shop Primer for Exterior Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat; Tneme-Zinc 90-97; Tnemec Company, Inc.

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E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, except as noted below. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL

A. Concrete Materials and Properties: Normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless higher strengths are indicated.

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2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. 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.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

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K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.8 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.9 METAL STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs, and platforms, and as required to anchor, hang, and contain the stairs on the supporting structure.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Commercial class.

C. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Weld headers to strings, and framing members to strings and headers.

1. Where required, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of shaft-wall construction.
2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

D. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch (1.7 mm).

1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.

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E. Steel Stair Finishes:

1. Shop prime and field paint all steel stairs systems

2.10 HANDRAILS AND RAILINGS AND GUARDRAILS

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

B. Interconnect members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections of pipe and tube, cope ends of intersecting members to fit contour of tube to which end is joined, and weld all around.

C. Form changes in direction of handrails and rails as detailed.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of pipe and tube handrail and railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect railing posts to metal framing by direct welding, unless otherwise indicated.
2. Connect railing posts to concrete by inserting into preset sleeves, attaching to floor brackets, or core drilling, as indicated.

H. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

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Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

K. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

L. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

M. For nongalvanized handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

N. Steel Handrail Finishes:

1. Provide black finish for steel pipe and non-galvanized finish for other steel components of interior steel railings and handrails. Provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in masonry and concrete construction.
2. Provide hot-dipped galvanized finish for all components of exterior steel handrail and railing system including fittings, brackets, anchors, fasteners, and sleeves.
3. Shop prime and field paint all steel handrails and railings.

2.11 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Siderails: Continuous, 1/2-by-2-1/2-inch (12-by-64-mm) steel flat bars, with eased edges, spaced 18 inches (457 mm) apart.

C. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced 12 inches (300 mm) o.c.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

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F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

G. Galvanize ladders, including brackets and fasteners, in the following locations:

1. Exterior.
2. Interior, where indicated.

2.12 METAL GRATINGS

A. Metal Bar Gratings: Form to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual"

1. Steel Gratings: Fabricate from welded steel grating with 1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 15/16 inch (24 mm) o.c. and crossbars at 4 inches (100 mm) o.c., NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL. Surface shall be smooth.
   a. Application: Elevator pit sump pit cover

2. Steel Frames: Fabricate from ASTM A 36/A 36M steel angle, 1-1/2" x 1-1/2" x 1/4" in size unless otherwise noted, with welded anchor for casting into slab.

B. Fabricate grating with steel angle or steel plate carrier at each end for attachment to frame. Secure grating to frame with removable bolts; provide tamper proof bolts for exterior locations.

C. Do not notch bearing bars at supports to maintain elevation

D. Steel Grating Finishes:

1. Provide hot-dipped galvanized finish for all components of elevator pit gratings and mechanical room floor gratings including fittings, brackets, anchors, fasteners, and sleeves.
2. Provide hot-dipped galvanized finish for all steel frames for gratings.
3. Shop prime and field paint all steel gratings and steel framing members.

2.13 LOOSE BEARING AND LEVELING PLATES

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

B. Galvanize plates after fabrication.

2.14 LOOSE STEEL LINTELS

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

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B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm), unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

E. Shop prime and field paint all lintels, leave embedded portions of lintels unpainted.

2.15 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Galvanize and prime paint steel frames.

2.16 CAST-IRON WHEEL GUARDS

A. Provide wheel guards made from cast-iron, 3/4-inch-thick, hollow-core construction, of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.

B. Prime cast-iron wheel guards with zinc-rich primer

2.17 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast aluminum or cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: Vertical, to discharge into pipe

B. Prime cast-iron downspout boots.

2.18 MANHOLE FRAME AND COVER

A. Manhole Frames and Covers:

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1. Description: Ferrous; 24-inch ID by 4-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover
2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated
3. Basis of Design Product: Neenah Foundry R-1593-B or equal.

2.19 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, tubes, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated, and in exterior locations.

2.20 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.21 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware..

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

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C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes indicated as unpainted, and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.

1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
2. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. 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.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. 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.

E. 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.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

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A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING RAILINGS AND HANDRAILS

A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Use steel pipe sleeves preset and anchored into concrete for installing posts where indicated. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.
3. Where indicated, core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions
4. Cover anchorage joint of post with flange of same metal as post where indicated.
5. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
6. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
7. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For hollow masonry anchorage, use toggle bolts.

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4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members

3.4 SETTING 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 grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING 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, if any.

B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

3.6 INSTALLING CAST-IRON WHEEL GUARDS

A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

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SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, furring, supports, and nailers.
2. Plywood backing panels.
3. Plywood ceiling sheathing at canopy.
4. Plywood wall sheathing
5. OSB wall sheathing with integral water-resistive barrier and air barrier (ZIP system)
6. Air infiltration barrier.

1.2 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

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A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.

1.5 QUALITY ASSURANCE

A. All composite wood, engineered wood, or agrifber products (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings..

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, and Use Category UC3b for exterior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. The use of CCA preservative treated wood is prohibited.

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B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Exterior type for exterior locations and where indicated.
4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.
4. Sleepers
5. Cants

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and the following species: Mixed southern pine; SPIB.

C. For concealed boards, provide lumber with 19 percent maximum moisture content of the following species and grades:

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1. Spruce-pine-fir (south) or Spruce-pine-fir, Construction or 2 Common grade; NELMA, NLGA, WCLIB, or WWPA.

2.5 PLYWOOD PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

1. Paint before mounting of equipment.

B. Plywood Ceiling Sheathing: DOC PS 1; Exposure 1, Structural I sheathing; span rating to suit framing in each location and in thickness indicated.

C. Plywood Wall Sheathing: DOC PS 1; Exposure 1, Structural I sheathing; span rating to suit framing in each location and in thickness indicated.

D. Plywood Roof Sheathing: DOC PS 1; Exposure 1, Structural I sheathing; span rating to suit framing in each location and in thickness indicated.

E. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than ½ inch (13 mm).

1. Provide fire-retardant-treated panels for interior locations unless indicated.
2. Provide preservative-treated panels for exterior locations unless indicated.

2.6 WALL SHEATHING WITH INTEGRAL WATER-RESISTIVE BARRIER AND AIR BARRIER

A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing with factory-laminated water-resistive barrier facer with printed fastener location symbols.

1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System Sheathing.
2. Span Rating, Panel Grade and Performance Category: Exposure 1, Structural I sheathing; span rating to suit framing in each location.
3. Edge Profile: Square edge.
4. Facer: Medium-density, phenolic-impregnated sheet material qualifying as a Grade D weather-resistive barrier in accordance with ICC AC38.
5. Provide fastener spacing symbols on facer for 16-inch (406 mm) and 24-inch (610 mm) on center spacing.
6. Thickness: As indicated on Drawings.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners:

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1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Self-Adhering Seam and Flashing Tape for ZIP System: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC-ES AC148, and tested as part of an assembly meeting performance requirements.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape.
2. Thickness: 0.012 inch

C. Liquid-Applied Flashing Membrane for ZIP System: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing/weather barrier and self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendation for integration with ZIP System Tape.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Liquid Flash.
2. Hardness, Shore A, ASTM C 661: 40 to 45

2.8 ACCESSORY MATERIALS

A. Weather Resistant Barrier: Asphalt-saturated organic felt, ASTM D 226, Type 1 (No. 15 asphalt felt), unperforated.

2.9 AIR-INFILTRATION BARRIER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; and UV stabilized.

1. Polyethylene sheet; 0.0038 to 0.0064-inch (0.097 to 0.163 mm) thick; formed by spinning continuous strands of fine, high-density-polyethylene interconnected fibers and bonding them together by heat and pressure; incorporating an additive to provide ultraviolet light resistance for up to 120 days; and with a water-vapor transmission rate equaling 200 g through 1 sq. m of surface in 24 hours according to ASTM E 96, Desiccant Method (Method A).

a. Available Products: DuPont; Tyvek CommercialWrap, or approved equivalent.

B. Air-infiltration Barrier Tape:

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1. For taping seams in building wrap provide oriented polypropylene film coated with a permanent acrylic adhesive; DuPont Contractor Tape, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 PANEL PRODUCT INSTALLATION

A. Fastening Methods: Fasten panels as indicated below:

1. Plywood Backing Panels: Screw to supports.
2. Miscellaneous Concealed Plywood Panels: Screw to supports.
3. Wall Sheathing: Screw to supports.
4. Ceiling Sheathing: Screw to supports.
5. Roof Sheathing: Screw to supports. Space panels 1/8 inch (3 mm) apart at edges and ends.

B. ZIP System: Comply with manufacturer’s directions for installation. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs. Support all panel edges. Space square-edged panels 0.125 inch apart.

1. Apply ZIP System Tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.
2. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with ZIP System Tape.

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3.3 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.4 AIR-INFILTRATION BARRIER INSTALLATION

A. Air-Infiltration Barrier Application: Cover ZIP sheathing with air-infiltration barrier as follows:

1. Cut back air-infiltration barrier ½ inch (13-mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply proprietary building wrap to comply with manufacturer's written installation instructions. Tape all vertical and horizontal seams.
3. Apply air-infiltration barrier to cover vertical flashing with a 6-inch (150-mm) overlap

END OF SECTION 061053

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SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cellular PVC (“AZEK”) bead boards and trim pieces, and other applications indicated on Drawings.

1.2 SUBMITTALS

A. Product Data: For each type of product and process specified and incorporated into items of exterior finish carpentry during fabrication, finishing, and installation.

B. Samples for Verification: For the following:

1. Cellular PVC (“AZEK”) trim, boards, and moldings, minimum 6 inches long, for each profile and application used in the work.

1.3 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation of exterior finish carpentry only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that exterior finish carpentry can be supported and installed as indicated.

1.5 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fabrications that fail in materials within specified warranty period.

1. Cellular PVC Material Warranty Period: Lifetime from date of Substantial Completion against manufacturing defects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cellular PVC Trim, Boards and Fabricated Products: Provide in styles and profiles as indicated on drawings and as required, with smooth surface both sides.

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1. Basis of Design Products: Provide AZEK Beadboard and Trim manufactured by AZEK Building Products, or equal.
2. Size: As selected by Architect for each application.

2.2 INSTALLATION MATERIALS

A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, pressure-preservative treated, kiln-dried to less than 15 percent moisture content.

B. Screws and Nails: Stainless steel, type of fastener recommended by manufacturer .

C. Adhesives and Sealants for Cellular PVC Units: Type recommended by manufacturer for applications indicated.

2.3 FABRICATION, GENERAL

A. Fabricate finish carpentry to dimensions, profiles, and details indicated.

B. Cellular PVC Products: Comply with manufacturer's directions for fabrication, routing and assembly of components.

2.4 SHOP FINISHING

A. Opaque Finish: Shop prime and backprime all items of opaque finished architectural woodwork and field finish paint; comply with Section 099100.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install finish carpentry true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

B. Scribe and cut finish carpentry to fit adjoining work.

C. Anchor finish carpentry to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with finish carpentry.

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D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of trim available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Cellular PVC Products: Comply with manufacturer's directions for installation methods. Glue and mechanically fasten to substrate along unit's entire length to minimize expansion and contraction. Glue joints.

3.2 ADJUSTING AND CLEANING

A. Repair damaged and defective finish carpentry, where possible, to eliminate functional and visual defects; where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

B. Clean finish carpentry on exposed and semiexposed surfaces.

END OF SECTION 062013

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SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior wood trim for opaque finish, of stock design.

1.2 SUBMITTALS

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

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed finish carpentry 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: As indicated on Drawings or if not indicated, as selected by Architect.

B. Wood Species and Cut for Opaque Finish: Poplar, Select Grade, no fingerjoints.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

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D. VOC Limits for Installation Adhesives and Glues: Comply with the maximum VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.2 INSTALLATION MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated.

C. Provide stock trim pieces in profiles as indicated on Drawings or if not indicated, as selected by Architect.

D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

2.4 SHOP FINISHING

A. General: Shop prime and backprime all items of opaque finished architectural woodwork at fabrication shop before shipment to site; comply with requirements of Section 099100 for preparation and priming of wood.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing finish carpentry, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing finish carpentry, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

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3.2 INSTALLATION

A. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

B. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

D. Wood Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
2. Install trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

F. Refer to Division 09 Sections for final finishing of opaque-finished finish carpentry.

3.3 ADJUSTING AND CLEANING

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

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 062023

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SECTION 064020 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood bench in shower room, custom fabricated.
2. Plastic laminate-faced countertop supports and vanity

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and attachment devices, including concealed blocking and reinforcement specified in other Sections.

C. Samples for Verification: For the following:

1. Lumber with or for transparent finish, 50 sq. in. (300 sq. cm), for each species and cut, finished on 1 side and 1 edge.
2. Plastic-laminate-clad products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: An experienced fabricator who has completed architectural woodwork 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. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

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C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.5 PROJECT CONDITIONS

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

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Low-Emitting Materials: All composite wood, engineered wood, or agrifber products (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI)

C. Wood Products: Comply with the following:

1. Softwood Plywood: DOC PS 1, Medium Density Overlay.

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D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Colors, Patterns and Finishes: As scheduled, or if not scheduled as selected by Architect.
2. Basis of Design Products: Wilsonart HPL, as selected by Architect.
3. Other Accceptable Manufacturers:
   a. Formica Corporation.
   b. Laminart.
   c. Panolam Industries International, Inc.

E. Wood Species for Bench: Teak.

2.2 INSTALLATION MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm)

C. Complete fabrication, including assembly, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.4 PLASTIC-LAMINATE CABINETS AND CASEWORK (VANITY)

A. Quality Standard: Comply with AWI Section 10 requirements for custom laminate cabinets.

B. Grade: Premium

C. AWI Type of Cabinet Construction: Full overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

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1. Horizontal Surfaces Other Than Tops: HGS.
2. Postformed Surfaces: HGP.
3. Vertical Surfaces: HGS.
4. Edges: HGS

E. Materials for Semiexposed and Concealed Surfaces: Thermoset decorative overlay.

F. Colors, Patterns, and Finishes: As scheduled, or if not scheduled, as selected by Architect.

G. Substrate: Plywood made with exterior glue.

2.5 WOOD BENCH

A. Custom fabricate teak wood bench for shower area to dimensions indicated. Provide teak backless bench with a contoured seat, similar to Rosemont Teak Shower Bench by GoldenTeak, Lawrence, MA. Bench shall be fabricated with smooth edges and be shop finished in teak oil or tung oil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Sections cited for fabrication and in the same grade, as specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

3.3 ADJUSTING AND CLEANING

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

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064020

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SECTION 066023 - EXTERIOR FIBERGLASS FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior fiberglass reinforced polyester column covers.

B. Related Work Specified Elsewhere:

1. Division 06 Section "Exterior Finish Carpentry" for cellular PVC trim boards and fabricated products.

1.2 SUBMITTALS

A. Product Data: For each type of product and process specified and incorporated into items of exterior fiberglass fabrications during fabrication, finishing, and installation.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of blocking and nailers, including concealed blocking and reinforcement specified in other Sections.

C. Product Certificates: Signed by manufacturers of fiberglass fabrications certifying that products furnished comply with requirements

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installations 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. Fabricator Qualifications: A firm experienced in producing fiberglass fabrications similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.4 PROJECT CONDITIONS

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A. Weather Limitations: Proceed with installation of exterior fiberglass fabrications only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Field Measurements: Where fiberglass fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support fiberglass fabrications by field measurements before being enclosed and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating fiberglass fabrications without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that exterior fiberglass fabrications can be supported and installed as indicated.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fiberglass fabrications that fail in materials within specified warranty period.

1. Material Warranty Period: Lifetime from date of Substantial Completion against manufacturing defects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Reinforced Polyester (FRP): Products shall be manufactured using polyester resins and reinforced chopped glass fibers. Exposed surfaces shall be UV-inhibited polyester gel-coat for field applied coatings. Structural reinforcing shall be added as required. where necessary.

B. Columns: Fabricate column shafts, capitals and bases from the same fiberglass reinforced polyester resin composite. Column designs shall have proportions based on the Classical Orders of Architecture. Provide in styles and shapes as indicated, factory prime painted.

1. Basis of Design Products: Provide ClassicGlas Fiberglass Columns by Melton Classics, Inc. or equal.
2. Column Design: As indicated on Drawings.

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3. Size: As indicated on Drawings.
4. Thickness of FRP Components: 1/4" to 3/16" including gel coat.
5. Fabricate in sections for field assembly.

2.2 INSTALLATION MATERIALS

A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, pressure-preservative treated, kiln-dried to less than 15 percent moisture content.

B. Nails: Aluminum, hot-dip galvanized, or stainless steel.

C. Screws: Aluminum, bronze, hot-dip galvanized, or stainless steel.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts, unless otherwise indicated. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

E. Adhesives and Sealants for Fiberglass Units: Type recommended by manufacturer for applications indicated

2.3 FABRICATION, GENERAL

A. Fabricate fiberglass fabrications to dimensions, profiles, and details indicated.

B. Fabricate columns split for reassembly on site. Shafts, capitals and bases shall be split in half and shall be fitted with reattachment tabs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing fiberglass fabrications, examine shop-fabricated work for completion and complete work as required, including removal of packing.

B. Prepare substrates for connection devices carefully, using approved shop drawings and preparation methods provided by manufacturer.

C. Install all supplementary support; wood blocking, metal studs, or any other supports specified by manufacturer.

3.2 INSTALLATION

A. Install fiberglass fabrications true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

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B. Connect FRP components in accordance with approved shop drawings. Use only stainless steel fasteners permitted for use in all connections. Allowing no more than ¼ inch in 10 feet variation from approved shop drawings, also align all vertical and horizontal seams.

C. Secure individual units as indicated, accurately fitted true to line and slopes as indicated and required for proper alignment with adjacent work.

D. Caulk joints as indicated in the approved shop drawings.

E. Scribe and cut fiberglass fabrications to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

F. Anchor fiberglass fabrications to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with fiberglass fabrications.

G. Field finish fiberglass fabrications in accordance with Section 099100 after installation is completed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective fiberglass fabrications, where possible, to eliminate functional and visual defects; where not possible to repair, replace fiberglass fabrications. Adjust joinery for uniform appearance.

END OF SECTION 066023

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SECTION 066116 - SOLID SURFACE MATERIAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid surface material fabricated into the following:

1. Solid surface material countertops.
2. Solid surface material window sills.

B. Related Sections include the following:

1. Blocking and grounds, including supports for solid surface material countertops, is specified in Division 06 Section "Miscellaneous Carpentry".
2. Sealants are specified in Division 07 Section "Sealants."

1.2 ACTION SUBMITTALS

A. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions, cutouts for insertion of wire management units, and coordination requirements with adjacent work.

B. Samples: Submit minimum 6" x 6" samples of selected colors and patterns. Where color is not specified, provide full range of manufacturer's available color samples for selection by Architect.

C. Product Data: Indicate product description, fabrication information, and compliance with specified performance requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.

B. Fabricator's Certificate: Submit certificate from manufacturer stating that fabricator is certified by manufacturer for this work.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced and licensed by manufacturer for production of solid surface fabrications similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

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B. Fire-Test-Response Characteristics: Provide materials with surface-burning characteristics as indicated below, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less

1.5 JOB CONDITIONS

A. Do not deliver components to project site until areas are ready for installation. Store indoors.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.

D. Coordination: Furnish inserts and anchorages which must be built into other work. Coordinate delivery with other work to avoid delay.

1.6 WARRANTY

A. General: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty. The manufacturer warrants to the original purchaser for commercial use that the manufacturer will at its option repair or replace, without charge, such product if it fails due to a manufacturing defect during the first 10 years after initial installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturers: Provide Basis of Design Products or equal product of one of the following:

1. AristechAcrylics, LLC.
2. DuPont Polymers
3. Formica

2.2 MATERIALS

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A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with the material and performance requirements of ANSI Z124.3, Type 6, without a precoated finish.

1. Thickness: 1/2 inch.
2. Color and Pattern: As scheduled or indicated for each location.
3. Finish: Semigloss.
4. Basis of Design Product: Corian Solid Surface by DuPont Polymers, or equal.

2.3 MISCELLANEOUS MATERIALS

A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints with chemical bonding.

1. VOC content shall not exceed 250g/l.

B. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

1. Adhesives shall have a VOC content of 70 g/L or less.

2.4 FABRICATION

A. General: All fabrications shall be made using solid surface material. Fabrications shall be adhesively jointed with no exposed seams and having edge details as indicated on drawings. No exposed fasteners shall be allowed.

B. Factory fabricate components into single unit to sizes and shapes indicated, in accordance with approved shop drawings.

C. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.

D. Provide factory cutouts for bowls, plumbing fittings and accessories as indicated on the drawings.

E. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.

F. Countertops: Fabricate tops in one piece. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing. Provide countertops with backsplash, endsplashes, aprons and nosings as shown.

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1. Total top thickness shall be as indicated on the Drawings. Provide built-up fabrication as required to obtain required total thickness.

G. Edges: Provide built-up edge 1-1/2" thick with profile as indicated on Drawings or if not indicated, as selected by Architect.

H. Allowable Tolerances

1. Variation in component size: ±1/8".
2. Location of openings: ±1/8" from indicated location.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surface to receive work and conditions under which work will be installed. Do not proceed with work until all unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product installation data.

B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

3.3 ADJUST AND CLEAN

A. Clean exposed surfaces using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period. Repair work or replace damaged work that cannot be repaired as required.

B. Keep components and hands clean during installation. Remove adhesives, sealants, and other stains. Replace stained components.

END OF SECTION 066116

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SECTION 071700 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes geotextile/bentonite sheet waterproofing.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include product specifications and manufacturer's written installation instructions.

B. Shop Drawings: Show installation details for interface with other work.

C. Material Certificates: For each type of bentonite waterproofing, signed by manufacturers.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain bentonite waterproofing system through one source from a single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.

B. Store materials in a dry, well-ventilated space.

C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.

1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
2. Placing of bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

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1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agrees to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Water penetrating the building or structure resulting from substrate cracking of up to 1/8 inch (3 mm).
b. Deteriorated or displaced waterproofing materials.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 (0.85-mm) sieve.

B. Bentonite Mastic: Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.

C. Granular Bentonite Tubes: Manufacturer's standard 2-inch- (50-mm-) diameter, water-soluble tube containing approximately 1.5 lb/ft. (2.2 kg/m) of bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.

D. Preformed Waterstop: Flexible strip of bentonite waterproofing compound in cartridge or coil form; designed specifically for vertical and horizontal joints in concrete construction.

2.2 GEOTEXTILE/BENTONITE SHEETS

A. Regular Geotextile/Bentonite Sheet: Minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite clay granules between two layers of polypropylene geotextile fabric, one woven and one nonwoven, needle punched and heat fused together.

1. Product: Provide one of the following:
a. Carlisle Coatings & Waterproofing; CCW MiraCLAY.
b. CETCO, a subsidiary of Minerals Technologies, Inc.; VOLTEX.

2.3 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite drainage panels, 3-dimensional, nonbiodegradable, manufactured with a permeable

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geotextile bonded to molded-plastic-sheet drainage core and designed to effectively convey water.

1. Vertical Application: Provide product with properties suitable for use vertically:
   a. Thickness: 0.40 inches (10.16 mm) min.
   b. Compressive Strength per ASTM D 1621: 15,000 pounds per sq. ft..
   c. Filter Fabric Tensile Strength per ASTM D 4632: 100 pounds min.
   d. Filter Fabric Puncture Resistance per ASTM D 4833: 65 pounds.
   e. Filter Fabric Apparent Opening Size per ASTM D 4751: Sieve size 70 max.
   f. Product: Subject to compliance with requirements, provide one of the following or equal:
      1) Hydroduct 220,GCP Applied Technologies, Inc.
      2) CCW MiraDRAIN 6000/6200, Carlisle Coatings and Waterproofing.

2.4 INSTALLATION ACCESSORIES

A. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant..

B. Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- (13- or 25-mm-) diameter washers under fastener heads.

C. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."

D. Tapes: As recommended in writing by waterproofing manufacturer for joints between sheets or panels.

E. Adhesive: Water-based adhesive used to secure membrane to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.

   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of bentonite waterproofing.
   2. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that substrate is complete and that all work that will penetrate waterproofing is complete and rigidly installed. Verify locations of waterproofing termination.

3.2 PREPARATION

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A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.

B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cementitious patching material according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. Install waterproofing and accessories according to manufacturer's written instructions, standard details, and recommended practices.

1. Apply linear joint-sealing tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.

B. Static Construction Joints: Protect construction joints with bentonite preformed waterstop flexible strips. Either place concrete directly over flexible strips or press strips into preformed cavities. Comply with manufacturer's written instructions where joint waterproofing is not otherwise indicated.

C. Apply granular bentonite continuously at base of wall waterproofing (on footing, against wall) according to manufacturer's written instructions.

D. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.

E. Apply sealants to comply with requirements specified in Division 07 Section "Joint Sealants" and with manufacturer's written instructions.

3.4 GEOTEXTILE/BENTONITE SHEET INSTALLATION

A. Install a continuous layer of waterproofing sheets directly against surface to be waterproofed. Lap ends and edges a minimum of 4 inches (100 mm) on horizontal and vertical substrates unless otherwise indicated. Stagger end joints between sheets a minimum of 24 inches (600 mm). Fasten seams by stapling to adjacent sheet or nailing to substrate.

B. Below Structural Slabs-on-Grade: Place waterproofing sheets on compacted substrate with ends and edges lapped and stapled.

1. Install a layer of waterproofing sheets under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.

C. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally against wall. Secure with masonry fasteners spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.

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1. Termination at Grade: Extend waterproofing sheets to within 2 inches (50 mm) of finish grade, unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction

3.6 FIELD QUALITY CONTROL

A. Inspection: Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturer's written instructions.

1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

B. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 071700

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Spray foam insulation, closed cell type.
3. Intumescent spray foam, hybrid system.
4. Insulation accessories.

B. Related Sections:

1. Section 075323 "EPDM Roofing" for insulation specified as part of roofing construction.
2. Section 078446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
3. Section 092900 "Gypsum Board" for installation of acoustical blankets in metal-framed assemblies.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For spray foam Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

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.

B. Spray Foam Applicator: An authorized representative who is trained and approved by manufacturer.

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

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manufacturer's written instructions for handling, storing, and protecting during installation.

B. Store spray foam materials in an area protected from freezing and overheating damage and in accordance with manufacturer's instructions.

C. 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 before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Products: Provide named products by Owens Corning or equal products by one of the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Pactiv Building Products.

2. Type IV, 25 psi (173 kPa).
3. Thickness: As indicated on Drawings for each application.
4. Edges: Square
5. Basis of Design Products:
   a. Below Grade Applications: Foamular 250.
   b. Above Grade Applications: Foamular High-R CW Plus.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

2.2 SPRAY FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2.5 lb/cu. ft. and minimum aged R-value of 7.0 deg F x h x sq. ft./Btu at 75 deg F at 1 inch thickness, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Compressive Strength: Minimum 40 psi (276 kPa)

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2. Basis of Design Product: Provide Icynene Inc.; Icynene ProSeal HFO or comparable product by one of the following:
   a. DuPont (formerly Dow).
   b. Henry Company.

3. Application: Provide for perimeter seal where indicated on Drawings.

B. Closed-Cell Spray Polyurethane Foam Hybrid System: Two separate layers of ASTM C1029, Type II compliant closed-cell foam: Staycell® 302 spray polyurethane foam as the base layer covered with Staycell ONE STEP 255 intumescent spray polyurethane foam as the exposed surface layer. System shall have a Class A/Class 1 flame spread and smoke developed rating and shall qualify as an Alternative Thermal Barrier Assembly when installed exposed without thermal barriers, ignition barriers or other fire protective surfaces.

1. Thickness: As indicated on Drawings.
2. Alternative Acceptable Product: Icynene Classic Max.
3. Application: Provide for exposed walls (where gypsum board is not installed as a finish) in attic, second story and elsewhere as indicated on Drawings.

2.3 INSULATION FASTENERS

A. Z-Clips/Z-Furring for Continuous Insulation: Thermally broken, z-shaped rigid insulation panel support/attachment system.

1. Basis of Design Product: ThermaFast Z-Track by The Steel Network, Inc or equal by Armatherm.
2. Spacing: 24” o.c.
3. Sizes:
   a. 1-1/2” deep at Wall Type 4 (exterior behind metal panels).
   b. 2” deep at interior face of exterior walls.

4. Fasteners: As recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by spray foam insulation manufacturer where required for adhesion of insulation to substrates.

B. At-Grade Insulation Protection Flashing Material: Solid core, concrete grey colored, UV protected exterior grade PVC flashing material designed to protect rigid insulation board from degradation due to exposure to outdoor elements and maintenance impacts.

1. Basis of Design Product: EnergyFlash by EnergyEdge or equal.
2. Provide premolded corners at all corner transitions.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

B. Priming: Prime substrates where recommended by spray foam insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF SPRAY FOAM INSULATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Do not apply insulation within 3 inches (76 mm) of heat-emitting devices or where temperature exceeds 200 deg F (93 deg C) per ASTM C411, or in accordance with applicable codes.

E. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

F. Cavity Walls: Install into cavities to fully fill void.

G. Miscellaneous Voids: Apply in accordance with manufacturer's written instructions

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3.4 INSTALLATION OF INSULATION FOR FRAMED AND FURRED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam Plastic Rigid Board Insulation: Install continuous insulation in conjunction with Z-clips in conformance with Z-clip manufacturer’s directions.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. 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 072100

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SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Asphalt shingles.
2. Self-adhering sheet underlayment.
3. Felt underlayment.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples for Verification: For asphalt shingles, demonstrating colors and textures to be provided.

C. Shop Drawings: Show details and waterproof connections to adjoining work and at obstructions and penetrations.

D. Installer’s Qualifications: Demonstrating compliance with requirements.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain all shingles, including ridge and hip cap shingles, through one source from a single asphalt shingle manufacturer.

B. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

C. Installer Qualifications: Roof shingle system shall be installed by a GAF Certified or Master Elite Roofing Contractor in order to obtain the specified warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

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1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period.

1. Material Warranty Period: 40 years from date of Substantial Completion against manufacturing defects.
2. Wind Warranty: 15 years with maximum 110 MPH wind warranty.
3. Algae Discoloration Warranty: 10 years limited warranty against blue-green algae discoloration.
4. Provide GAF System Plus Limited Warranty, or equal.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Dimensions: 13-1/4" x 39-3/8"
2. Exposure: 5-5/8"
3. Algae Protection: StainGuard
4. Basis of Design Product: Provide Timberline HDZ Shingles by GAF or equal product by one of the following:
   a. CertainTeed
   b. Owens Corning.

5. Color: As selected by Architect.

B. Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

1. Basis of Design Product: TimberTex Premium Ridge Cap shingles by GAF, or equal

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C. Starter Shingles: GAF Starter Strip Shingles, or equal.

2.2 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type I (15#), asphalt-saturated organic felts, nonperforated.

B. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0- mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

1. Product: StormGuard by GAF or equal.

2.3 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into roof sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

2.4 METAL FLASHING AND TRIM

A. Sheet Metal Flashing and Trim: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

1. Sheet Metal: Aluminum, mill finish for open valleys, white painted for exposed trim including drip edge.
2. Drip Edges: Fabricate from aluminum in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (9.6-mm) drip at lower edge.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

PART 3 - EXECUTION

3.1 EXAMINATION

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A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Single-Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.

1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.
2. Application: Install single-layer felt underlayment system on roofs with slope greater than 4 on 12.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

1. Install at roof edge, transitions and all other locations as indicated on drawings
2. Sidewalls and Roof-Penetrating Elements (Dormers, Chimneys, Skylights, etc): Extend beyond penetrating element 18 inches (450 mm) and return vertically against penetrating element not less than 4 inches (100 mm), unless otherwise indicated on Drawings.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

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1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

3.4 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 3/4 inch (19 mm) over fascia at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.

1. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.

E. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 073113

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SECTION 074113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Factory-formed and field-assembled, standing-seam metal panels used for roof applications.
2. Fasteners and clips
3. Flashing, trim, fascia, closures and other components of roof panel system.
4. Sheet underlayment.
5. Snow guards

B. Related Sections Include the Following:

1. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

C. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "*Approval Guide*" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A- 90.
2. Hail Resistance: MH.

D. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 SUBMITTALS

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A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Indicate locations and spacing of snow guards on roof.

C. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Roof Panels: 12-inches (300 mm) long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
2. Trim and Closures: 12-inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
4. Snow Guard: One typical unit.

E. Qualification Data: For Installer.

F. Maintenance Data: For metal roof panels to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

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

1. Engineering Responsibility: Preparation of data for metal roof panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

D. Layout of Snow Guards: Snow guard manufacturer shall provide project-specific layout of vertical spacing and number of rows needed for installation of snow guards.

1.5 DELIVERY, STORAGE, AND HANDLING

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A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures, including rupturing, cracking, or puncturing.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural

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performance required.

1. Surface: Smooth, flat finish

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0- mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

1. Product: Ice and Water Shield by GCP Applied Technologies or equal.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Adhesives for Snow Guards: Double sided adhesive tape of type recommended by and furnished by snow guard manufacturer.

1. Basis of Design Product: Normount Double-Sided Tape by Norton, supplied by Alpine SnowGuards, or equal.

2.4 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by

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lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

B. Vertical-Rib, Snap Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping one panel over the adjacent one to form the seam.

1. Basis-of-Design Product: Snap Clad by PAC-CLAD Metal Roofing, a Carlisle Company, or an approved equivalent product of one of the following:
   a. AEP-Span (ASC Profiles).
   b. Petersen Aluminum Corp
   c. CENTRIA Architectural Systems.
   d. ATAS International, Inc

2. Material: .032" aluminum.
   a. Exterior Finish: Fluoropolymer, 2-coat or 3-coat as selected by Architect.
   b. Color: As selected by Architect from manufacturer's standard colors.

3. Clips: Fixed.
   a. Material: 0.0528-inch- (1.35-mm-) thick, aluminum-zinc alloy-coated steel sheet.

4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 16"
6. Panel Seam Height: 1-3/4".
7. Uplift Rating: UL 90.

2.5 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge and hip closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- (0.64-mm-) thick, stainless-steel.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roofing panels, and same finish. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases,

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framed openings, ridges, hips, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

D. Snow Guards: Half-round pad mounted type snow guards fabricated from .032" thick aluminum designed for mechanical or adhesive attachment to standing-seam metal roof panels. Finish type and color shall match roofing sheets.

1. Basis of Design Product: PD30 by Alpine SnowGuards, or equal by one of the following:
   a. Berger Bros. Co..
   b. Zaleski

2.6 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
5. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "*Metal Finishes Manual for Architectural and Metal Products*" for recommendations for applying and designating finishes.

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B. Protect mechanical and painted 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 are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate metal roofing with flashing, trim, and construction of walls and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Promptly remove protective film, if any, from exposed surfaces of metal roofing. Strip with care to avoid damage to finish.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install wrinkle free, complying with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm), staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

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3.4 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.
2. Install panels perpendicular to roof deck.
3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
4. Provide metal closures at rake edges, rake walls and each side of ridge caps.
5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install ridge caps as metal roof panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of aluminum roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division0 7 Section "Joint Sealants."

3.5 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer. Match existing installation, which may include the following:

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seam Joint: Snap lock seam as per manufacturer’s directions.
4. Comply with UL-90 uplift requirements for clip spacing and attachment methods.

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3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.7 SNOW-GUARD INSTALLATION

A. Snow-Guard: Install snow-guards according to manufacturer's written installation instructions, at locations and spacings per manufacturer’s recommendations.

1. Installation Method: adhered to metal roof pans with double-sided tape per tape manufacturer’s written directions.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

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B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

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SECTION 074600 - SIDING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Fiber-cement siding.
2. Fiber-cement trim.

B. Related Sections include the following:

1. Division 07 Section "Joint Sealants."

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For siding and trim.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- (300-mm-) long-by-actual-width Sample of siding.
2. 12-inch- (300-mm-) long-by-actual-width Sample of trim.

D. Product Certificates: For each type of siding, signed by product manufacturer.

E. Research/Evaluation Reports: For each type of siding required.

1.3 QUALITY ASSURANCE

A. Source Limitations for Siding: Obtain each type, color, texture, and pattern of siding, including related accessories, through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.6 SEQUENCING

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A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

1. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
2. Warranty Period:
   a. Siding: 50 years from date of Substantial Completion
   b. Finish: 15 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 SIDING

A. Fiber-Cement Plank Siding: Siding made from fiber-cement board that does not contain asbestos fibers; complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Provide HardiBoard manufactured by James Hardie Inc. or equal by one of the following:
   a. Cemplank, Inc.
   b. CertainTeed Corp
   c. MaxiTile, Inc.

2. Board Pattern: Artisan HZ10 Smooth Lap Siding by James Hardie, Inc.
3. Size: 5/8" thick x 8-1/4" w x 12' long planks.
4. Exposure: 7"
5. Finish: Prime painted for field finishing.

B. Fiber-Cement Board Siding: Siding made from fiber-cement board that does not contain asbestos fibers; complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Provide HardiBoard manufactured by James Hardie Inc. or equal by one of the following:
   a. Cemplank, Inc.
   b. CertainTeed Corp
   c. MaxiTile, Inc.

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2. Pattern: HardiePanel HZ10 Smooth Vertical Siding by James Hardie, Inc.
3. Panel Size: 4'-0" x 8'-0" w.
4. Thickness: 5/16" thick
5. Battens and Trim: Sizes as indicated on Drawings; match siding color and texture; HardiTrim in lengths required.
6. Finish: Integral color, in color selected by Architect.

2.2 ACCESSORIES

A. Siding Accessories: Provide starter strips, edge trim, corner cap, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories made from same material as adjacent siding, unless otherwise indicated.
2. Provide accessories matching color and texture of adjacent siding, unless otherwise indicated.

B. Trim and Soffit: Match material, color and texture of siding; provide in shapes and sizes indicated on drawings.

1. Finish: Match adjacent siding.
2. Provide non-vented smooth soffit panels 1/4" thick.
3. Provide Artisan HZ10 accent trim for locations as indicated on Drawings.
4. Provide crown molding trim where indicated on the Drawings; selected by Architect.

C. Elastomeric Joint Sealant: Refer to Section 079200. Match siding colors

D. Fasteners: Provide Type 304 stainless steel fasteners of types recommended by siding manufacturer, and as follows:

1. For fastening to wood, ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm) or 3 screw-threads into substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

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A. General: Comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind.

B. Cut edges of fiber-cement siding and trim carefully and clean up any rough edges by smoothing and sanding after cutting. Finish field cut edges to match factory cut edges before installing.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective siding materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to siding manufacturer's written instructions and maintain in a clean condition during construction.

C. Touch-up field finished and factory finished siding and trim, including small nicks and scratches and all exposed nail heads with finish to match siding.

END OF SECTION 074600

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SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered EPDM membrane roofing system.
2. Roof insulation.

B. Related Sections:

1. Division 06 Section “Miscellaneous Rough Carpentry” for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, edge securement, and counterflashings.
3. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Division 22 Section "Storm Drainage Piping Specialties" for roof drains

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested according to FM Approvals 4474, UL 580, or UL 1897 to resist the following uplift pressure calculated according to ASCE/SEI 7.

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1. Design Pressures: As indicated on Drawings.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificate:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Warranties: Sample of special warranties.

E. Field inspection reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

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B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation, edge securement, fasteners and accessories for membrane roofing system from same manufacturer as membrane roofing where required for specified warranty or FM approval; obtain all roofing components from sources approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Drawings and Specifications: Where Drawings and Specifications require flashing terminations that are higher than required by membrane manufacturer and other conditions that are more restrictive than required by membrane manufacturer for warranty specified, the work shall be performed as shown on the Drawings and as specified herein. Where there is no detail drawn for a condition that exists, provide manufacturer's recommended detail for specific condition.

F. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture,

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approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roofing accessories, metal roof edge securement, and other components of membrane roofing system.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.

1. Basis of Design Product: Provide Sure Seal EPDM roofing system by Carlisle SynTec Incorporated or equal.
2. Other Acceptable Manufacturers:
   a. Firestone Building Products.
   b. GenFlex Roofing Systems.
   c. Johns Manville.

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3. Thickness: 45 mils nominal.
4. Exposed Face Color: Black
5. Membrane Edges: Selvage edge with 3” or 6” wide factory-applied SecurTAPE applied along the length of the membrane for splicing.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application; color to match field membrane.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

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B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 3 (25 psi nominal (+/- 10%) compressive strength), glass-fiber mat facer on both major surfaces.

1. Tapered or flat boards in thickness indicated on drawings.
2. R-Value: Minimum 6 per inch in accordance with LTTR test method.
3. Maximum board size: 48 by 48 inches.
4. Board Thickness: 2 inches (51 mm) maximum. Provide multi layered insulation systems for thickness greater than 2 inches (51 mm) .
5. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
   a. Provide thicknesses indicated

6. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated. Fabricate to slopes indicated.

2.4 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.5 METAL ROOF EDGE SECUREMENT

A. Provide metal roof edge securement members as specified in Division 07 Section “Sheet Metal Flashing, Fabrications and Trim.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

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2. Verify that surface plane flatness and fastening of metal roof decking and plywood substrate complies with requirements of membrane manufacturer.
3. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers.

1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation. Provide staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.

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1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
2. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

A. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type. Size fasteners of sufficient length using the shortest screw that is at least 3/4 inch (19 mm) longer than the assembly being secured.

1. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Set each subsequent layer of insulation in either ribbons of bead-applied insulation adhesive or a uniform coverage of full-spread insulation adhesive, as recommended by manufacturer, firmly pressing and maintaining insulation in place.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation.

1. Provide additional 6 inch wide pressure sensitive membrane flashing overlay at all seams.
2. Apply lap sealant and seal exposed edges of roofing membrane terminations.

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H. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

I. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

J. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 ROOF EDGE SECUREMENT INSTALLATION

A. Comply with requirements specified in Division 07 Section “Sheet Metal Flashing, Fabrications and Trim.”

3.7 FIELD TESTS AND INSPECTIONS

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

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A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Metal flashing.
2. Reglets.
3. Copings.
4. Gutters and downspouts.
5. Metal trim.

1.2 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Low-slope membrane roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Building Code of NYS, Chapter 16 and tested for resistance in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings..

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces

1.3 ACTION SUBMITTALS

A. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples for Verification: Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.

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1. 8-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch- (300-mm-) long samples of factory-fabricated products exposed as finished Work and accessories, as specified below.
   a. Copings.
   b. Gutters
   c. Downspouts

1.4 INFORMATIONAL SUBMITTALS

A. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

C. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

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B. Performance Warranty: Include copings and roof edge flashings in Total System Warranty provided by roofing membrane manufacturer; refer to Section 075323.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:

1. Aluminum Sheet: ASTM B 209, Alclad 3003-H14, with a minimum thickness as indicated.
2. Extruded Aluminum: ASTM B 221, alloy 6063-T52, with a minimum thickness of 0.080 inch for primary legs of extrusions, unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 07 Section "Joint Sealants."

E. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

G. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

H. Slip Sheet: 3-lb. rosin-sized building paper or Tyvek by DuPont.

I. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40 mils (1.0 mm) thick; slip-resisting, polyethylene-film-reinforced top surface laminated to

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SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Product: Ice and Water Shield by GCP Applied Technologies.or equal.

J. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

K. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. General: Provide items designed and fabricated to fit applications indicated and to perform optimally with respect to weather resistance, water tightness, durability, strength, and uniform appearance.

B. Expansion Provisions: Fabricate running lengths to allow controlled expansion not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation or damage.

C. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

1. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
2. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
7. Material: Fabricate reglets from the following metal, in thickness indicated:
   a. Aluminum, 0.024 inch (0.6 mm) thick.

8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Fry Reglet Corporation.
   b. OMG Roofing Products.
   c. Keystone Flashing Company

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D. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Basis of Design Product: Permasnap Coping manufactured by OMG Roofing Products or equal product of one of the following:
   a. Carlisle
   b. Metal-Era Inc.

2. Coping-Cap Material: Formed aluminum, 0.040 inch thick.
   a. Finish: Two-coat fluoropolymer

3. Corners: Factory mitered and continuously welded
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material .
5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
6. Vertical Face and Back Leg Height: as indicated on Drawings.

E. Hanging Gutters: Provide K-Style gutters, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 10-foot- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Metal Material: Aluminum.
2. Metal Thickness: 0.032" min.
3. Size: 6".
4. Finish: Manufacturer’s standard painted finish in white.
5. Basis of Design Manufacturer: Berger Bros.

F. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Metal Material: Aluminum.
2. Metal Thickness: 0.024" min.
3. Size: 4" .
4. Finish: Manufacturer’s standard painted finish in white.
5. Basis of Design Manufacturer: Berger Bros.

2.4 FABRICATION, GENERAL

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for

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forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams in Aluminum: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

C. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches (600 mm)of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with mastic sealant (concealed within joints.)

D. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

E. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

F. Conceal fasteners and expansion provisions unless noted otherwise. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

G. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Miscellaneous Exposed Trim: Fabricate from the following material:

1. Aluminum: 0.040 inch (1 mm) thick

C. Base Flashing, Counterflashing, Step Flashing, Flashing Receivers, Drip Edge: Fabricate from the following material:

1. Aluminum: 0.032 inch (0.813 mm) thick

2.6 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

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B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
2. Color: White, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof-Edge Flashings and Edge Securement: Secure metal flashings and edge securement at roof edges according to Building Code of NYS, Chapter 16 for specified wind zone.

D. Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by sheet metal producer.

E. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work

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cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form nonexpansion, but movable, joints in aluminum to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams in Aluminum: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing copper or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper over one layer of felt underlayment before installing sheet metal.
2. Bed flanges in a thick coat of roofing cement where required for waterproof performance.

I. Install reglets to receive counterflashing according to the following requirements:

1. Where reglets are shown in concrete, furnish reglets for installation under Division 03 Section "Cast-in-Place Concrete."
2. Where reglets are shown in masonry, furnish reglets for installation under Division 04 Sections.

J. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

K. Copings: Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners. Anchor copings to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

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B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 076200

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in fire-resistance-rated horizontal assemblies.
3. Penetrations in non-fire-resistance-rated horizontal assemblies.
4. Penetrations in smoke barriers, smoke partitions and smoke tight partitions.

1.2 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products

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per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
   a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
   b. Classification markings on penetration firestopping correspond to designations listed by the following:
      1) UL in its "Fire Resistance Directory."
      2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
      3) FM Global in its "Building Materials Approval Guide."

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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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. Penetration Firestop Systems specified in the Schedule in Part - 3 include:
   a. Fire Barrier Products, 3M Fire Protection Products
   b. RectorSeal Corporation.

2. Subject to compliance with specified requirements, provide Penetration Firestop Systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory (BXRH), by one of the following:
   a. Hilti, Inc.
   b. Nelson Firestop Products.
   c. RectorSeal Corporation.
   d. Specified Technologies Inc.
   e. 3M Fire Protection Products.
   f. Wiremold/Legrand

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist 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.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors and floor/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

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E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

H. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping 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 to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

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 elastomeric sheet bonded to galvanized-steel sheet.

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E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

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 of grade indicated below:

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 opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping 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

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A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping 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.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: 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 firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
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.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping.

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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

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

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 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 is 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 and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. For penetrations in non-fire rated horizontal assemblies, smoke barriers, smoke partitions and smoke tight partitions, provide systems tested for 1 hour unless otherwise noted.

C. Basis of Design Assemblies: Subject to compliance with requirements, provide the design indicated below or a comparable UL design by one of manufacturer’s listed in Part 2 above.

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1. Schedule of construction components, type of penetrant, and U.L. Penetration Firestop Systems include, but are not limited to the following:

	PENETRANT						
	Metal Conduit	**Cable Tray[4]**	**Cables**	**Non-Insul. Metal Pipe**	**Insul. Pipe**	**FR Polypro-pylene Pipe**	**Insul. Metal Duct**
GWB Stud Wall, or Shaft Wall up to 2 Hr Rating	W-L-1001	W-L-4004	W-L-3001	W-L-1001	W-L-5011	W-L-2002	W-L-7006 [3]
CMU Wall up to 2 Hr Rating	C-AJ 1044	C-AJ-4003	C-AJ-3030	C-AJ-1044	C-AJ-5001	C-AJ-2001	C-AJ-7003[3], 7016[3]
Concrete Floor / Metal Deck 1 Hr Rated F and T-Rating[2]	C-AJ-1008	N/A	C-AJ-3029	C-AJ-1008	C-AJ-5002	F-A-2002	C-AJ-7009[5]
Concrete Floor / Metal Deck 2 Hr Rated F and T-Rating[2]	C-AJ-1008	N/A	C-AJ-3029	C-AJ-1008	C-AJ-5060	F-A-2002	N/A
Concrete Floor / Metal Deck up to 2 Hr F Rated[1]	F-A-1002	N/A	C-AJ-3030	C-AJ-1044	C-AJ-5001	F-A-2002	N/A

KEY TO NOTES

1. Penetration within wall cavity.
2. Penetration that does not fall within wall cavity, T-Rating required.
3. Up to 1 hour rating, submit engineered judgement firestopping system for this combination of penetrant, wall/floor assembly, and fire rating. Install fire dampers in 2-hour walls in accordance with manufacturer's instructions and testing agency requirements.

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4. Where cable tray extends through wall.
5 . For floor penetrations not enclosed above and below the floor with shaft wall.

D. Membrane Penetrations:

1. Firestop membrane penetrations by cables, pipes and conduit similar to through wall penetrations.
2. Provide putty pad box wrap firestopping for membrane penetrations in rated walls for electrical back boxes over 16 sq. inches, where any back boxes are located within 24 inches horizontal of another back box, or when total area of back boxes exceeds 100 sq in. in 100 sq. ft. of wall area.

E. Where another type of construction or penetrant is encountered, or if field conditions vary from those described in the U.L. System listed (i.e. annular space is greater/smaller, insulation type varies, etc.), provide firestopping systems which are appropriate, and U.L. tested, for that condition.

END OF SECTION 078413

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SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.2 ACTION SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

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B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
   a. Fire-resistive joint system products bear classification marking of qualified testing agency.
   b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
      1) UL in its "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

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A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. 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. Grace Construction Products.
   b. Hilti, Inc.
   c. RectorSeal Corporation.
   d. Specified Technologies Inc.
   e. 3M Fire Protection Products.
   f. Tremco, Inc.; Tremco Fire Protection Systems Group.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
2. 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. Grace Construction Products.
   b. Hilti, Inc.
   c. Johns Manville.
   d. RectorSeal Corporation.
   e. Specified Technologies Inc.
   f. 3M Fire Protection Products.
   g. Tremco, Inc.; Tremco Fire Protection Systems Group.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Fire-resistive joint system sealants 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.

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2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system 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 fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

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B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

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A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM / FIRESTOP JOINT SYSTEM SCHEDULE

A. Where UL-classified firestop joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

Firestop Joint System Location	**Basis-of-Design**	**Assembly Rating**	**Nominal Joint Width**	**Movement Capabilities [2]**
Floor-to-Wall				
Rated concrete masonry wall construction intersection with adjacent floor construction	FW-D-1012, FW-D-1013	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Class II
Head-of-Wall				
Rated gypsum wall construction intersection with steel floor deck above	HW-D-0087, or HW-D-0089	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Class II or III,
Rated gypsum wall construction intersection with concrete floor deck above	HW-D-0083, HW-D-209	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Class II
Rated concrete masonry wall construction intersection with steel floor deck above	HW-D-0081, or HW-D-0098	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Class II
Rated concrete masonry wall construction intersection with concrete floor deck above	HW-D-0268, HW-D-0097	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Class II

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Bottom-of-Wall				
Rated gypsum wall construction intersection with concrete floor	BW-S-0002	1 hour or 2 hours[1]	As indicated, or required by tested assembly	Static

1. Rating to match wall construction.
2. Class UL2079

B. Where another type of construction is encountered, or if field conditions vary from those described in the U.L. System listed (i.e. annular space is greater/smaller, insulation type varies, etc.), provide firestopping systems which are appropriate, and U.L. tested, for that condition.

END OF SECTION 078446

ATTACHMENT: FIRESTOP JOINT SYSTEMS SUBMITTAL SHEET

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3.8 FIRESTOP JOINT SYSTEMS SUBMITTAL SHEET

A. **HEAD-OF-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Gypsum wall construction intersection with floor deck above: _____. Gypsum wall construction intersection with roof deck above: _____.
2. Concrete masonry wall construction intersection with floor deck above: _____.
3. Concrete masonry wall construction intersection with roof deck above: _____.

B. **FLOOR-TO-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Concrete masonry wall construction intersection with adjacent floor construction: _____.

C. **BOTTOM-OF-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Gypsum wall construction intersection with floor deck: _____. Gypsum wall construction intersection with roof deck above: _____.
2. Concrete masonry wall construction intersection with floor _____.
3. Concrete masonry wall construction intersection with roof deck above: _____.

D. **CURTAIN WALL FIRESTOPPING:** Fill in the design number and copy test. Insert n/a if condition is not applicable.

1. Aluminum mullion and glass spandrel panel curtainwall intersection with adjacent floor construction:
2. Gypsum sheathed curtainwall intersection with adjacent floor construction: _____.

E. **OTHER:** Where another type of construction or penetrant is encountered, attach a separate sheet listing each condition and attach copy of the U.L. Test.

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

a. Control and expansion joints in cast-in-place concrete
b. Joints in architectural concrete masonry unit veneer wall surfaces.
c. Joints at cast stone units.
d. Joints at fiber cement siding and trim.
e. Joints between different materials listed above
f. Perimeter joints between materials listed above and frames of frames of doors, louvers and windows.
g. Control and expansion joints in ceiling and overhead surfaces.
h. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
b. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
f. Tile control and expansion joints
g. Openings and joints in sound-rated partitions.
h. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Control and expansion joints in tile flooring.
b. Control and expansion joints in cast-in-place concrete slabs.
c. Other joints as indicated.

B. Related Sections include the following:

1. Sealants used in glazing are specified in Division 08 "Glazing."

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2. Coordinate work of this section with all sections referencing it.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples 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.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

B. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.

C. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

D. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

E. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

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A. Installer Qualifications: Engage an installer who has successfully completed at least three (3) joint sealer applications similar in type and size to that of this project within the last five (5) years. All workers used for work of this Section shall be experienced in the techniques of sealant application and shall be completely familiar with the published recommendations of the manufacturer of the joint sealant materials being used.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.
4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants by hand pull method described below:
   a. Install joint sealants in 60 inches (1500 mm)) joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
   b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches (50 mm) long at side of joint and meeting horizontal cut at top of 2-inch (50-mm) cuts. Place a mark 1 inch (25 mm) from top of 2-inch (50-mm) piece.
   c. Use fingers to grasp 2-inch (50-mm) piece of sealant just above 1-inch (25-mm) mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

6. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
7. Evaluation of Field 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.

D. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution:

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1. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.

E. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 01 Section covering this activity.

F. Random Field Tests: Periodically test sealants, in place, for adhesion, using methods recommended by sealant manufacturer. Promptly replace any sealant that does not adhere, fails to cure, or fails to perform as specified by the sealant manufacturer.

G. Field Water Test: Perform two field water tests on completed areas including as many conditions as possible. If leakage occurs during testing, repair as required, and re-test area and also test two additional locations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.9 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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1. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Warranty: Provide written warranty agreeing to repair or replace, at no cost to Owner, defective materials for twenty (20) years, and workmanship for two (2) years from the Date of Substantial Completion. Defective materials and workmanship shall include, but are not limited to:

1. Deterioration, aging or weathering of the work;
2. Water leakage and/or air leakage;
3. Sealant loss of adhesion, loss of cohesion, cracking or discoloration;
4. Staining or discoloration of adjacent surfaces;
5. Joint failure due to building or joint movement up to the limits prescribed by the manufacturer;
6. Cracks or bubbles on sealant surface.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's standards or custom colors to match Architect's samples, as directed by Architect.

C. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.

D. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 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.

E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project

2.2 LATEX JOINT SEALANT

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A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, paintable latex acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.

1. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. AC-20; Pecora Corporation.
   b. Tremflex 834; Tremco.
   c. ALEX PLUS; DAP .

B. Uses: General interior use, paintable.

2.3 MILDEW-RESISTANT SILICONE JOINT SEALANT

A. Single-Component Mildew-Resistant Silicone Sealant: Manufacturer's standard, non-modified, one-part, silicone sealant; complying with ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to non-porous joint substrates indicated, O. Formulate sealant with fungicide and specifically intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.

1. Available Products: Subject to compliance with requirements, silicone joint sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. 786 Mildew Resistant; Dow Corning.
   b. Sanitary 1700; GE Silicones.
   c. 898 Silicone Sanitary Sealant; Pecora Corporation.
   d. Tremsil 600 White; Tremco.

B. Uses: Interior use in wet locations, and all toilet and shower rooms.

2.4 NONSAG URETHANE JOINT SEALANT

A. Multicomponent Nonsag Urethane Sealant: Manufacturer's standard, non-modified, multi-part, nonsag urethane sealant; complying with ASTM C 920, Type M, Grade NS, Class 25, Uses NT, M, G, A, and as applicable to joint substrates indicated, O.

1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. Dynatrol II, Pecora Corporation
   b. Sikaflex-2c NS, Sika Corporation
   c. Dymeric 240FC; Tremco.
   d. Masterseal NP 2; Master Builders Solutions Div., BASF

B. Uses: Interior use for exposed concrete or masonry wall control joints

2.5 SILICONE JOINT SEALANT

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A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100, for Use G, A, M, O; non-staining and field-tintable.

1. Basis of Design Product: Provide Pecora Corporation “890FTS” sealant or equal manufactured by one of the following:
   a. Dow Corning Corporation.
   b. GE Advanced Materials - Silicones
   c. Sika Corporation, Construction Products Division
   d. Tremco Incorporated

B. Additional Movement Capability: 100 percent movement in extension and 50 percent in compression for a total of 150 percent movement.

C. Uses: General exterior use.

2.6 POURABLE URETHANE JOINT SEALANT

A. Multicomponent Pourable Urethane Sealant: Manufacturer's standard, non-modified, two-part, urethane sealant; complying with ASTM C 920, Type M, Grade P, Class 25, Uses T, M, A and, as applicable to joint substrates indicated, O.

1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. NR-200 Urexpan, Pecora Corporation
   b. Sikaflex 2c SL, Sika Corporation
   c. Masterseal SL 2; Master Builders Solutions Div., BASF

B. Uses: Interior or exterior use for level pavement or slab joints.

2.7 NONSAG URETHANE JOINT SEALANT

A. Multi-Part Non-Sag Urethane Sealant: Except as otherwise indicated, provide manufacturer's standard, non-modified, two-part, urethane sealant; complying with ASTM C 920, Type M, Grade NS, Class 25, Uses T, M, A and, as applicable to joint substrates indicated, O.

1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. Sikaflex 2c NS; Sika Corp
   b. Dynatred, Pecora Corporation
   c. Masterseal NP 2; Master Builders Solutions Div., BASF

B. Uses: Interior or exterior use for pavement or slab joints where slope exceeds one percent.

2.8 ACOUSTICAL JOINT SEALANTS

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A. Acoustical Sealant: Non-sag (gun grade), non-flammable, latex-based sealant designed to limit sound transmission through interior STC-rated partitions. Sealant remains flexible and adhered to metal, wood, plaster, gypsum, and concrete after drying.

1. Maintains the STC rating of partitions with intersections and penetrations sealed with product: Tested by independent, accredited, NVLAP facility according to ASTM E 90.
2. Products: Provide one of the following:
   a. QuietZone Acoustic Sealant by Owens Corning.
   b. OSI GreenSeries SC-175 Draft & Acoustical Sound Sealant by Henkel Corporation
   c. Pecora AIS-919: Acoustical and Insulation Latex Sealant by Pecora Corporation
   d. Smoke ‘N’ Sound Acoustical Sealant by Specified Technologies Inc.

B. Uses: At penetrations through and intersections of sound-rated wall, floor and ceiling assemblies in order to preserve their ability to reduce airborne sound impact noise transmission.

2.9 PREFORMED FOAM SEALANTS

A. Preformed Foam Sealants: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:

1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
2. Impregnating Agent: Chemically stabilized acrylic.
3. Density: Manufacturer's standard.
4. Backing: None.
5. Available Products: Subject to compliance with requirements, preformed foam sealants that may be incorporated in the Work include, but are not limited to, the following:
   a. "Emseal," Emseal Corp.
   b. "Emseal Greyflex," Emseal Corp.
   c. "Wil-Seal 150," Wil-Seal Construction Foams Div., Illbruck.
   d. "Wil-Seal 250," Wil-Seal Construction Foams Div., Illbruck.

2.10 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type 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.

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B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
2. Manufacturer: Provide Cera-Rod manufactured by W.R. Meadows, Inc., or equivalent.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.11 JOINT FILLERS FOR EXTERIOR CONCRETE SLABS

A. General: Provide joint fillers of thickness and depth indicated, or if not indicated 1/2" thick by depth of joint.

B. Bituminous Fiber Joint Filler: Provide preformed strips of with asphalt binder encased between two layers of saturated felt or glass-fiber felt, complying with ASTM D 1751.

1. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint and seal with sealant.

2.12 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 in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with 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

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affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. 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 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 printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

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1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   a. Do not leave gaps between ends of joint fillers.
   b. Do not stretch, twist, puncture, or tear joint fillers.
   c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
   a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

F. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or

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deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following hollow-metal work:

1. Steel doors
2. Steel door frames
3. Borrowed-light and sidelight frames.
4. Fire-rated door and frame assemblies.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 088000 “Glazing” for glazing inserted in hollow metal doors and frames..

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.3 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

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

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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.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 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.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Republic Doors and Frames.

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 indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

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1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-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. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. Provide for interior door and frame locations.

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 (44.5 mm).
   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16 gage 0.053 inch (1.3 mm).
   d. Edge Construction: Model 1, Full Flush
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
      1) Provide mineral core for fire rated doors.

3. Frames:

   a. Materials: Minimum thickness of 16 gage, 0.053 inch (1.3 mm), uncoated, steel sheet for the following locations:
      1) Wood doors, unless otherwise indicated.

   b. Materials: Minimum thickness of 14 gage, 0.067 inch (1.7 mm), uncoated, steel sheet (except provide metallic coated where door is metallic coated) for the following locations:
      1) Level 3 steel doors
      2) Wood doors at all leafs wider than 36-inches (914-mm), and all electrical rooms, storage rooms, machine rooms, mechanical rooms, and maintenance areas

   c. Construction: Full profile welded.

4. Exposed Finish: Prime door and frames

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

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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. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.

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 (44.5 mm.)
   c. Faces: Metallic-coated steel sheet, minimum thickness of 14 gage, 0.067 inch (1.7 mm), with minimum A60 (ZF180) coating.
   d. Edge Construction: Model 2, Seamless (continuously welded seams, edge filled, dressed smooth).
   e. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate core at manufacturer's discretion.

      1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.

3. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 12 gage, 0.093 inch (2.3 mm), with minimum A60 (ZF180) coating.
   b. Construction: Full profile welded.

4. Exposed Finish: Prime door and frames

2.5 FRAME ANCHORS

A. Jamb Anchors:.

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. 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 (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

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2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Sections 088000 "Glazing".

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

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:

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1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) 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 (3.2 mm in 51 mm).
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 where required for attachment of weather stripping 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 (19 mm) 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 (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

      1) Two anchors per jamb up to 60 inches (1524 mm) high.
      2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
      4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

   b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

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1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) 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 butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for

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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.

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 (0.4 mm) 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.

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B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), 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:

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a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

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.

END OF SECTION 081113

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SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior stile and rail wood doors, fire-rated and non fire-rated.
2. Interior stile and rail wood doors with louvers.
3. Fitting stile and rail wood doors to frames and machining for hardware.
4. Shop priming stile and rail wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door. Include details of construction and factory finishing specifications.

1. Include adhesive manufacturer's product data indicating urea-formaldehyde content.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data. Include the following:

1. Dimensions of doors for factory fitting.
2. Locations and dimensions of mortises and holes for hardware.
3. Undercuts.
4. Fire-protection ratings for fire-rated doors.
5. Indicate doors to be factory finished and finish requirements.

C. Product Certificates: Signed by door manufacturers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain stile and rail wood doors through one source from a single manufacturer.

B. Quality Standard for Doors: Comply with AWI's "Architectural Woodwork Quality Standards" (AWS) unless more stringent requirements are specified.

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags or cardboard cartons.

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C. Mark each door on top and bottom edge with opening number used on Shop Drawings

D. 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 temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, and have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
   a. Interior Doors: Five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use only materials that comply with referenced quality standards unless more stringent requirements are specified.

1. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

B. Low-Emitting Materials:

1. Provide doors made with adhesives and composite wood products that do not contain added urea-formaldehyde resins.

C. Medium-Density Fiberboard (MDF): Panel product complying with ANSI A208.2, Grade 155. Modulus of Rupture (MOR) = 4050 psi, Modulus of Elasticity (MOE) = 405,000 psi

D. Glazing: Refer to Section 088000.

2.2 STILE AND RAIL WOOD DOORS

A. Basis of Design Product: Supa Collection by VT Industries, or equal products by one of the following:

1. TruStile, a Marvin company

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2. Simpson Door Company.

B. Construction, General: Solid MDF with keyed wood-edge doors complying with AWS latest edition industry standard for wood stile and rail doors and with other requirements specified. Fire doors shall match appearance of non-rated doors.

1. Grade of Doors for Opaque Finish: Premium.
2. Panel Construction: Medium-density fiberboard (MDF).
3. Panel Designs: Drawings indicate panel designs. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
4. Performance Level: WDMA “Extra Heavy Duty.”

C. Door Construction for Opaque Finish:

1. Stile and Rail Construction: Solid-MDF with clear keyed poplar vertical outer edge.
2. Flat-Panel Construction: Solid panel product.
3. Edge Construction: At outer stile edges, provide keyed solid-poplar edge construction.

D. Interior Door Thickness: 1-3/4 “

E. Stile and Rail Widths: As indicated on Drawings.

F. Flat-Panel Thickness: Not less than 1/2 inch, except not less than 5/8" at fire rated doors..

G. Sticking Profile: As selected by Architect from manufacturer's full range.

H. Interior Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C. Provide Category A Positive Pressure doors.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Core Construction: Provide fire-resistant composite core material as required by the manufacturer's licensing agency to achieve fire ratings indicated.
4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
5. Fire-ratings: As indicated on the Drawings.

I. Interior Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

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J. Louver Doors: Manufacturers Standard solid MDF, Stile and Rail, louvers with individual 2-1/4” slats, 1-3/4" thick doors.

2.3 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
   a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.

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, BHMA-156.115-W, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable.

2.4 SHOP PRIMING

A. Doors for Opaque Finish: Shop apply one coat of wood primer specified in Division 09 Section "Painting" to faces and edges of doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors will be installed.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.

1. Install fire-rated doors in accordance with NFPA 80, Intertek/Warnock Hersey (WHI), and UL requirements as applicable.
2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or 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 081433

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SECTION 081436 - ALUMINUM-CLAD STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Swinging wood-framed glass doors for exterior locations with aluminum-clad exterior exposed surfaces and factory painted wood interior surfaces.
2. Exterior wood frames with aluminum-clad exterior exposed surfaces and factory painted wood interior surfaces.

B. Related Sections include the following:

1. Division 08 Section "Door Hardware" for hardware for swinging wood-framed glass doors.
2. Division 08 Section "Glazing" for glass vision panels in swinging wood-framed glass doors.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of in-swinging wood-framed glass door indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:

1. Mullion details including reinforcement and stiffeners.
2. Joinery details.
3. Full-size details of typical composite members including reinforcement.
4. Flashing details.
5. Weather-stripping details.
6. Hardware.
7. Glazing details.
8. Accessories.

C. Maintenance Data: For weatherstripping, finishes, operable panels and operating hardware to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain swinging wood-framed glass doors through one source from a single manufacturer.

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B. Product Options: Drawings indicate size, profiles, and dimensional requirements of swinging wood-framed glass doors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect swinging glass doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store off ground and covered in a clean, dry, well-ventilated, protected space. Comply with manufacturer's written instructions.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify swinging wood-framed glass door openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating swinging wood-framed glass doors without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace swinging wood-framed glass doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection.
c. Water leakage, air infiltration, or condensation.
d. Faulty operation of movable panels and hardware.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
f. Insulating-glass failure.

2. Warranty Period: Ten years from date of Substantial Completion.
3. Warranty Period for Glass: Twenty years from date of Substantial Completion.

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4. Warranty Period for Finish on Exterior Metal Cladding: Twenty years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturers: Provide specified aluminum-clad wood doors and frames manufactured by Marvin or equal products by one of the following:

1. Kolbe & Kolbe
2. Pella.

2.2 MATERIALS AND FINISHES

A. General: Comply with AAMA /NWWDA 101/I.S.2 requirements.

B. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.

C. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, minimum 0.050" thick, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by swinging wood-framed glass door manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, and not less than 16,000-psi (110-MPa) minimum yield strength.

1. Fluoropolymer Two-Coat Finish System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   a. Color: As selected by Architect.

D. Glazing System and Glass: Manufacturer's standard factory-glazing system that produces a weathertight seal and is glazed with clear insulating-glass units with low-E3 coating and argon gas fill, with both lites tempered glass, overall thickness 3/4", complying with requirements for safety glazing and with Division 08 Section "Glazing."

E. Hardware:

1. Hinges: Door manufacturer’s standard 4-1/2" x 4-1/2" square corner ball bearing hinges in finish selected by Architect. Four (4) hinges shall be provided per door leaf. Factory install hinges on door.
2. Remainder of hardware is provided under Section 087100.

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F. Grilles (False Muntins): Manufacturer's standard 7/8" wide false muntins placed between the glass lites (in the airspace) with 7/8" wide adhered muntins on exterior surfaces of glazing; wood on interior and aluminum clad on exterior, finished to match adjacent door surfaces.

G. Integral Fin at Frame: PVC or extruded- or rolled-aluminum nailing fins for securing frame to structure; provide sufficient strength to withstand design pressure indicated

H. Weatherstripping: Dual durometer compression vinyl weatherstripping at head and jambs and vinyl sill sweep.

I. Aluminum Sill: Extruded aluminum, anodized finish in color selected by Architect.

J. Wood Jamb Extensions: As required; unfinished pine, sizes as indicated, shipped loose.

K. Exterior Aluminum Casings: As required; finished to match frame, sizes and shapes as indicated, shipped loose

2.3 FABRICATION

A. General: Fabricate swinging wood-framed glass doors in sizes indicated that comply with AAMA/NWWDA 101/I.S.2 for performance class and grade indicated.

B. Basis of Design Products: Signature Ultimate Commercial Doors (UCD) manufactured by Marvin, or equal.

C. Doors: Fabricate swinging wood-framed glass doors as follows:

1. Reglazable from the interior without dismantling panel framing.
2. Laminated wood stiles and rails shall be doweled and glued at joints.
3. Exterior wood surfaces clad in pre-finished aluminum, interior wood (pine) factory finished in painted finish.
4. Panels shall be 1-3/4" thick.
5. Top rail shall be 6" high, stiles shall be 6" wide, bottom rail shall be 11-3/8" high.
6. Sill shall be thermal barrier saddle low profile .500" by 7.125".
7. Provide raised panels or flat panels on doors as selected by Architect; locate as indicated on Drawings.

D. Frames: Fabricate frames as follows:

1. Exterior wood surfaces clad in pre-finished aluminum, interior wood (pine) factory finished in painted finish.
2. Side and head jambs shall be solid, one-piece.
3. Frame thickness shall be 1-1/16".
4. Frame width shall be 4-9/16".

E. Factory-Glazed Fabrication: Glaze swinging wood-framed glass doors in the factory.

F. Prehung Doors: Factory hang doors on frames.

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G. Factory-Machining for Hardware: Factory machine swinging wood-framed glass doors for openings and hardware that is not surface applied.

2.4 WOOD FINISHES

A. Factory-Finished Doors and Frames: Manufacturer's standard paint finish, in white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances, rough opening dimensions, levelness of sill plate, coordination with wall flashings, vapor retarders, air retarders, water/weather barriers, and other built-in components; and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry and clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install swinging wood-framed glass doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air retarders, water/weather barriers, and other adjacent construction.

B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

C. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

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A. Protect swinging glass door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor swinging glass door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact swinging glass door surfaces, remove contaminants immediately according to manufacturer's written instructions.

B. Clean exposed surfaces immediately after installing swinging glass doors. Avoid damaging protective coatings and finishes. Remove excess glazing sealants, dirt, and other substances.

C. Refinish or replace doors with damaged finish.

D. Clean factory-glazed glass immediately after installing swinging glass doors. Comply with manufacturer's written instructions for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

END OF SECTION 081436

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SECTION 082250 - POLYESTER FACED DOORS AND ALUMINUM FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Fiberglass reinforced polyester (FRP) faced doors.

B. Related sections include the following:

1. Division 07 Section "Joint Sealants" for joint sealants installed as part of aluminum entrance and storefront systems.
2. Division 08 Section “Hollow Metal Doors and Frames.”
3. Division 08 Section "Door Hardware."
4. Division 08 Section "Glazing."

1.2 SYSTEM DESCRIPTION

A. General: Provide polyester faced doors and aluminum framing systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Thermal Movements: Provide polyester faced doors and aluminum framing systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change(range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Structural-Support Movement: Provide polyester faced doors and aluminum framing systems that accommodate structural movements including, but not limited to, sway and deflection.

D. Dimensional Tolerances: Provide polyester faced doors and aluminum framing systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.3 SUBMITTALS

A. Product data including specifications, standard details, and installation recommendations for polyester faced doors and panels and aluminum frames including test reports

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certifying that products have been tested and comply with performance requirements, details of core and edge construction, trim for openings, and finish.

B. Shop drawings showing fabrication and installation of polyester faced doors, panels and frames. Include elevations of door design types, details of construction, location and installation requirements of door hardware and reinforcements, and details of openings.

1. Provide schedule of doors indicating sizes, locations, and other pertinent information using same reference numbers for details and openings as those on contract drawings.

C. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors available for doors and panels.

D. Samples for Verification Purposes: Submit 6" square samples of each color of face sheet specified and 12" long sections of aluminum extrusions with specified finish system applied. Where normal color and texture variations are to be expected, include 2 or more units in each set of samples showing limits of such variations.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Provide doors and frames produced by single manufacturer for entire Project.

B. Manufacturer Qualifications: Provide product series that has produced by the manufacturer for at least five years, for similar building type and size as this project.

C. Installer's Qualifications: Firm with not less than 4 years successful experience installing systems similar to those required.

D. Fire Performance Characteristics: Where indicated, provide class "A" fiber reinforced polyester faces with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

E. Design Criteria: The construction documents are based on a specific polyester door faced and aluminum frame system. Other manufacturer's system of similar and equivalent nature will be acceptable when, in Architect's judgement, differences do not materially detract from design concept or intended performance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver doors cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to surface finishes.

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B. Inspect doors upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

D. Identify each door and frame with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in work.

B. Coordinate work of this section with that specified in Section 087100 to ensure proper installation of hardware.

1.7 WARRANTY

A. Product Warranty: Provide manufacturer's standard written warranty agreeing to repair or replace polyester faced doors which fail in materials or workmanship within time period indicated below. Warranty shall included door manufacturer's guarantee that hardware installed by factory will be installed correctly and not come loose within time period indicated below.

1. Warranty period for doors and finish, and hardware installed by factory is ten years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Provide polyester faced doors, panels and aluminum frames manufactured by one of following:

1. Special-Lite, Inc.
2. Tubelite, Inc.
3. Commercial Door Systems.

2.2 MATERIALS

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A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet and plate.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M)) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Fiberglass Reinforced Polyester Face Material: 0.120" minimum thickness, with color integral through full thickness of face sheet. Provide sandstone textured finish for doors and panels. Face material meeting the following performance criteria:

1. Impact Strength of Face Sheets: ASTM D 256, Izod Impact Strength, 15 foot pounds per inch of notch.
2. Abrasion Resistance of Face Sheets: ASTM D 1242, 25 cycles of Taber Abraser with CH-17 wheel with a 1000 gram load, not to exceed 0.029 percent weight loss.
3. Hardness of Face Sheets: ASTM D 2583, Barcol Meter Hardness Test, not less than 55.
4. Humidity Resistance of Face Sheets: ASTM D 570, water absorption not more than 0.40 percent weight gain after 24-hour immersion.
5. Ultra-Violet Degradation: Only slight color change, and negligible change in surface gloss and other physical properties after exposure to 500,000 Langleys.
6. Fire-Resistance and Flammability: Provide Class A rated faces for door faces of interior doors and for interior face of exterior doors and panels.
7. Product: SpecLite 3 FRP by Special Lite, or equivalent.

D. Core Material: Urethane foam of 5 pounds per cubic foot density for doors and panels.

E. Fasteners: Aluminum or stainless steel materials warranted by manufacturer to be non-corrosive and compatible with aluminum components, hardware, anchors and other components.

F. Brackets and Reinforcements: Manufacturer's high-strength aluminum extrusions. Provide manufacturer's standard reinforcement for each type of hardware required.

G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

H. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

I. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

J. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants."

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K. Glazing: 1" insulating glass units as specified in Division 08 Section “Glazing.”

2.3 DOORS

A. General: Provide manufacturer's standard panel embossed-style doors as indicated on Drawings constructed of aluminum stiles and rails joined with steel tie rods, with polyester face sheets and foamed-in-place urethane inner core. Minimum thermal rating U-factor of 0.09.

1. Basis of Design Product: Provide SL-18 or SL-19 Wood Grain Texture FRP/Aluminum Hybrid Doors by Special Lite, or equivalent.
2. Panel and vision lite arrangement shall be custom to match door elevations on Drawings.
3. Color of face sheets shall be as selected by Architect.
4. Finish of aluminum chassis shall be as selected by Architect.

B. Provide extruded aluminum 2-7/16" tubular stiles designed to accept specified hardware and a minimum extruded aluminum 2-5/16" top and bottom rails with legs for interlocking rigidity weather bar. Minimum thickness of 1/16 inches at face and 1/8 inch at hinge and concealed vertical stiles.

1. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
2. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.

C. Lock polyester face sheets in on all four sides by extruded interlocking edges which are integral part of stiles and rails. Snap in or applied door edge trim is not acceptable.

D. Miter or mortise and tenon corner joints and mechanically fasten with reinforcing brackets that incorporate concealed minimum 3/8" galvanized steel tie-rods at top and bottom with aviation type nuts.

E. Internally reinforce doors to receive specified hardware with .125 inch thick aluminum.

F. Foam-in-place core after the door is completely assembled.

G. Manufacture doors with cutouts for required vision lites. Provide screw-applied aluminum stops to match perimeter door rails.

H. Manufacture doors with embossed surface to match panel designs indicated on Drawings.

2.4 FRAMES

A. Hollow metal frames are specified in Division 08 Section “Hollow Metal Doors and Frames.”.

2.5 HARDWARE

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A. Hardware is specified in Section 087100.

2.6 FABRICATION

A. Factory-prefit and premachine doors for all hardware and to fit frame opening sizes indicated with the following uniform clearances and bevels:

1. Clearances: Not more than 1/8 inch at jambs and heads except between pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.
2. Comply with final hardware schedules and door frame shop drawings and with hardware templates.
3. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory premachining.

B. Complete fabrication, assembly, hardware preparation, finishing and other work before shipment to project site. Disassemble components only as necessary for shipment and installation. Field stick framing is not acceptable.

C. Factory install vision lites and panels.

D. Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator to prevent corrosion.

E. Maintain accurate relation of planes and angles, hairline fit contacting members.

F. Conceal fasteners where possible provide countersunk flat or oval heads for exposed screws and bolts.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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1. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color topcoat and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
2. Color: As selected by Architect.
3. Provide for door chassis as selected by Architect.

E. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

1. Provide for door chassis as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and supports, with the Installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of polyester faced doors. Correct unsatisfactory conditions before proceeding with the installation.

B. Examine door frames prior to hanging door:

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing FRP doors and aluminum framing systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint

C. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

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D. Install doors and frames plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

E. Construction Tolerances: Install doors and frames to comply with the following tolerances:

1. Variation from Plane: Do not exceed 1/16 inch in 12 feet of length or 1/8 inch in any total length.
2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed 1/16 inch.
3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8 inch.
4. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch.

F. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

1. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.
2. Paint dissimilar metals where drainage from them passes over aluminum.
3. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating.
4. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with two coats of aluminum house paint. Seal joints between the materials with sealant.

G. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible. Refer to Section 087100 for additional installation requirements.

H. Install perimeter sealant to comply with requirements of Division 07 Section "Joint Sealants," unless otherwise indicated.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

B. Clean complete system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

C. Institute protective measures required throughout remainder of construction period to ensure polyester faced doors will be without damage and deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 082250

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall access doors and frames for interior locations.
2. Fire-rated wall access doors and frames for interior locations
3. Ceiling access doors and frames for interior locations.
4. Fire-rated ceiling access doors and frames for interior locations.
5. Scissor attic stairs ceiling hatch, fire-rated.

B. Locations and Quantities of Access Doors: Not all access doors are shown on the Drawings. It is the intent of this section that access doors be provided wherever access is required for operation and maintenance of concealed equipment, dampers, valves, controls or similar devices.

C. Cylinders for access doors are specified in Division 08 Section "Door Hardware."

D. Related Requirements:

1. Division 07 Section "Roof Accessories" for roof hatches.
2. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 COORDINATION

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A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 PRODUCTS, GENERAL

A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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. Babcock-Davis.
2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
3. Karp Associates, Inc.
4. Larsen's Manufacturing Company.
5. Milcor Inc.
6. Nystrom, Inc.
7. Fakro

B. Flush Access Doors, with Exposed Trim, for CMU Surfaces: Units consisting of frame with exposed trim, door, hardware, and complying with the following requirements

1. Basis-of-Design Product: Nystrom Model NT, Universal Flush Access Door.
2. Assembly Description: Fabricate door to fit flush to frame. Provide flange integral with frame, 1 inch wide, overlapping surrounding finished surface.
3. Locations: Provide at non-rated concrete block walls.
4. Uncoated Steel Sheet for Door: Nominal 16 gage.
   a. Finish: Factory prime.

5. Stainless-Steel Sheet for Door for Toilet Rooms**,** Shower Rooms, and Other Wet Areas: Nominal 16 gage; No. 4 finish.
6. Frame Material: Nominal 0.060 inch (1.52 mm), 16 gage

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7. Hinges: Concealed continuous piano hinge.
8. Locks: Provide with mortise lock prep.

C. Trimless, Flush Access Doors for Gypsum Board Surfaces: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:

1. Basis-of-Design Product: Nystrom Model NW or equal.
2. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
3. Locations: Provide at non-rated gypsum board walls and ceilings.
4. Uncoated Steel Sheet for Door: Nominal 16 gage.
   a. Finish: Factory prime.

5. Stainless-Steel Sheet for Door for Toilet Rooms**,** Shower Rooms, and Other Wet Areas: Nominal 16 gage; No. 4 finish.
6. Frame Material: Nominal 0.060 inch (1.52 mm), 16 gage.
7. Hinges: Concealed continuous piano hinge.
8. Locks: Provide with mortise lock prep.

D. Insulated, Fire-Rated Access Doors for Drywall Walls and Ceilings: Units consisting of frame with gypsum board bead concealed edge trim, self-latching insulated door, and hardware, and complying with the following requirements:

1. Basis-of-Design Product: Nystrom Model IW, Insulated Fire Rated Access Door, with Drywall Bead, for Walls and Ceilings.
2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release.
3. Locations: Provide at rated gypsum board walls and ceilings.
4. Fire-Resistance Ratings:
   a. Walls: 1-1/2 hours.
   b. Ceilings: 3 hours.

5. Uncoated Steel Sheet for Door: 20 ga., 0.0359-inch- (0.91-mm-) thick steel sheet, welded pan type, filled with 2-inch (50 mm) thick fire-rated mineral-fiber insulation.
   a. Finish: Factory prime.

6. Stainless-Steel Sheet for Door for Toilet Rooms**,** Shower Rooms, and Other Wet Areas: Same gage and style as steel door; with No. 4 finish.
7. Frame Material: 16 ga., 0.0598-inch- (1.52-mm-) thick steel sheet, 1-inch (25.4 mm) wide, surrounded by galvanized drywall bead.
8. Hinges: Concealed continuous piano hinge.
9. Locks: Provide with mortise lock prep.

E. Insulated, Fire-Rated Access Doors for CMU Walls: Units consisting of frame with exposed edge trim, self-latching insulated door, and hardware, and complying with the following requirements:

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1. Basis-of-Design Product: Nystrom Model IT, Insulated Fire Rated Access Door, with Exposed Flange, for Walls and Ceilings.
2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide flange integral with frame, 1 inch (25 mm) wide, overlapping surrounding finished surface. Provide self-latching door with automatic closer and interior latch release.
3. Locations: Provide at rated concrete block walls.
4. Fire-Resistance Ratings:
   a. Walls: 1-1/2 hours.

5. Uncoated Steel Sheet for Door: 20 ga., 0.0359-inch- (0.91-mm-) thick steel sheet, welded pan type, filled with 2-inch (50 mm) thick fire-rated mineral-fiber insulation.
   a. Finish: Factory prime.

6. Stainless-Steel Sheet for Door for Toilet Rooms**,** Shower Rooms, and Other Wet Areas: Same gage and style as steel door; with No. 4 finish.
7. Frame Material: 16 ga., 0.0598-inch- (1.52-mm-) thick steel sheet, 1-inch (25.4 mm) wide exposed trim.
8. Hinges: Concealed continuous piano hinge.
9. Locks: Provide with mortise lock prep.

F. SCISSOR ATTIC STAIRS – FIRE RATED

1. Assembly Description: Fire-resistant door/hatch with ladder provides access to the attic, and serves as a fire door. Ladder folding system enables the ladder to be folded to smaller lengths. The inner part of the frame shall be equipped with an intumescent gasket.
2. Location: Where indicated.
3. Fire-Resistance Ratings: 60 minutes
4. Maximum Load: 350 lbs.
5. Metal Door: Insulated, 2” thick, with white painted finish, integrated locking latch and metal opening and closing rod.
6. Basis of Design Product: Fakro LSF Series Attic Ladder Model 66859-FAK or equal.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

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E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

F. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

G. Frame Anchors: Same type as door face.

H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

I. Mortise locks are specified in Section 087100.

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 attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
3. Provide mounting holes in frames for attachment of units to metal or wood framing.
4. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. Cylinder and keys are specified in Section 087100 "Door Hardware."

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, VOC-free, electrostatic-applied powder coat finish immediately after surface preparation and pretreatment.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional Satin Finish: No. 4.

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.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

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SECTION 083613 - SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of sectional overhead doors:

1. Doors with aluminum-framed, insulated glazed panels.
2. Tracks configured for the following lift types:
   a. Standard clearance

3. Electric motor operators

B. Related Sections include the following:

1. Division 08 Section "Door Hardware" for lock cylinders and keying.
2. Division 26 Sections for electrical service and connections for powered operators, and accessories.
3. Division 26 Sections for disconnect switches and circuit breakers for powered operators.

1.2 DEFINITIONS

A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 10,000 cycles.

C. Energy Performance:

1. Air Infiltration: Maximum air leakage of 0.4 cfm/ft2. Testing shall be performed in accordance with DASMA 105 test procedure.
2. With IG Low E Glass, Tested U-Factor of 0.72.
3. Provide an air leakage rating of 0.24 cfm/ft2 with optional IECC Compliance Package.

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1.4 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Manufacturers' Certificates: Signed by manufacturers certifying that they comply with requirements specified in "Quality Assurance" Article. On request, submit evidence of manufacturing experience.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.

1. Obtain operators and controls from the overhead coiling door manufacturer.

D. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

1.6 WARRANTY

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A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, for the following period:

1. Door Assemblies: Five years, with three years for glazing.
2. Motors: One year

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Provide specified products of Raynor Garage Doors or equal from one of the following manufacturers:

1. McKee Door, Inc.; A United Dominion Company.
2. Overhead Door Corporation
3. Clopay Building Products Co..
4. Wayne-Dalton Corp.
5. Windsor Door; A United Dominion Company.

2.2 PRODUCTS

A. Basis of Design Product: AlumaView AV300 by Raynor Garage Doors or equal.

2.3 OVERHEAD DOORS

A. Construct door sections from insulated glazing panels and insulated metal panels set in aluminum section framing, fabricated as stile and rail assembly secured with 1/4 inch (6 mm) diameter through rods.

1. Section Thickness: 3 inches deep.
2. Size: As indicated on Drawings
3. Panel Configuration: As indicated on Drawings.

B. Stiles and Rails: 6061 - T6 aluminum alloy extrusions, extrusion thickness 0.063" thick, and 0.090" thick at hardware mounting locations.

1. Center Stiles: 3 -5/8 inch wide.
2. End Stiles: 3-3/8 inches or 6-1/2 inches wide as determined by overall door width.
3. Top Rail: 6-1/2 inches wide.
4. Bottom Rail: 6-1/2 inches wide.
5. Pair of meeting rails: 5 inches wide
6. Finish: Powder-coat painted finish in color selected by Architect.

C. Glazing Units: 1 inch thick, clear insulating tempered glass units with Low-e coating.

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D. Reinforce sections with continuous horizontal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.

E. Provide reinforcement for hardware attachment.

F. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

G. Finish aluminum door sections and aluminum framing as follows:

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
3. Powder Coat Finish: Manufacturer’s standard process.
   a. Color: As selected by Architect..

2.4 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653 (ASTM A 653M), for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 3 inches (75 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

1. Provide 3" track with standard headroom configuration.

B. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 (ASTM A 36M) and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.

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1. Provide motor-operated doors with combination bottom weatherseal and sensor edge
2. In addition, provide continuous flexible seals at door jambs for a weathertight installation.

2.5 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch- (1.9-mm-) thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet (4.87 m) in width, unless otherwise recommended by door manufacturer.

C. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

D. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

E. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (75-mm-) diameter roller tires for 3-inch (75-mm) track, 2-inch- (50-mm-) diameter roller tires for 2-inch (50-mm) track.

F. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Single-jamb side, operable from inside only.
2. Lock cylinder is specified in Division 08 Section "Door Hardware.".
3. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.6 COUNTERBALANCING MECHANISM

A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229 (ASTM A 229M), Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 10,000 cycles minimum.

B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16

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feet (4.87 m) long and 2 additional brackets at one-third points to support shafts more than 16 feet (4.87 m) long, unless closer spacing is recommended by door manufacturer.

C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.7 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Type: Jackshaft with manual chain hoist.
2. Basis of Design Product: ControlHoist 2.0 Optima by Raynor Garage Doors or equal.

B. Comply with NFPA 70.

C. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

D. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically ngaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

E. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

F. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

G. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil reduction drive, and chain and sprocket secondary drive.

1. Operator shall meet UL325 - 2010 requirements for continuous monitoring of safety devices.

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H. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide motor rating of 115VAC, single phase, 60Hz.
5. HP: 1
6. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

I. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure
2. Provide one control station for each side of sectional door; interior or exterior type as required.
3. Provide 20 remote control operators for in-vehicle use to automatically open door when in proximity to door.

J. Fire Station Timer: Provide push button or pull cord to activate the open cycle and timer to close feature, with only the push button or pull cord controlling the timer to close.

K. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Electric Sensing Edge: Monitored to meet UL325 - 2010.

L. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 inches (600 mm) o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.4 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Schedule training with Owner with at least 7 days' advance notice

END OF SECTION 083613

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SECTION 085413 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes double-hung and awning fiberglass-framed windows.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide fiberglass windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:

1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance .

B. Structural Performance: Provide fiberglass windows capable of withstanding the effects of the wind loads indicated on drawings, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of fiberglass window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Glazing details.

C. Samples for Initial Selection: For units with factory-applied color finishes..

D. Product Schedule: For fiberglass windows. Use same designations indicated on Drawings.

E. Qualification Data: For installer and manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of fiberglass window. Test results based on use of downsized test units will not be accepted.

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G. Maintenance Data: For finishes to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to fiberglass window manufacturer for installation of units required for this Project.

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

C. Source Limitations: Obtain fiberglass windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of fiberglass windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA-certified fiberglass windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify fiberglass window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating fiberglass windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

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A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fiberglass windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of fiberglass, other materials, and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing: 20 years from date of Substantial Completion.
c. Fiberglass Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Elevate windows by Marvin or equal products by one of the following:
1. Andersen Windows and Doors
2. Pella

2.2 MATERIALS

A. Fiberglass Extrusions: Pultruded-fiberglass material, reinforced with interlocking mat. Provide Marvin Ultrex, or equal in the following thicknesses:

1. Awning Sash and Frame Cladding: 0.080" thick
2. Double Hung Sash and Frames: 0.075" thick.

B. Wood: Clear pine, kiln-dried to moisture no greater than twelve (12) percent at the time of fabrication, and water repellant preservative treated in accordance with WDMA I.S.4.

C. Fiberglass Trim and Glazing Stops: Material and finish to match frame members.

D. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with fiberglass window members, cladding, trim, hardware, anchors, and other components.

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1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

G. Replaceable Weather Seals: Comply with AAMA 701/702.

2.3 WINDOW PERFORMANCE

A. Window Type(s): Double-hung and awning.

B. AAMA/WDMA Performance Requirements: Provide fiberglass windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS.

1. Performance Class and Grade:
   a. Double Hung: LC-PG 35-H
   b. Awning: LC-PG50-AP

C. Thermal Transmittance: Provide fiberglass windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to NFRC 100.

1. U-Factor: 0.27 - 0.28 Btu/sq. ft. x h x deg F or less.

D. Solar Heat-Gain Coefficient (SHGC): Provide fiberglass windows with a whole-window SHGC maximum of 0.19 determined according to NFRC 200 procedures.

E. Air Leakage: Air leakage shall not exceed 0.30 cfm per square foot of frame when tested at 1.57 psf according to ASTM E283.

F. Water Penetration: No water penetration when tested at 6.06 psf for double hung and 7.5 psf for awning windows, according to ASTM E547.

2.4 GLAZING

A. Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed fiberglass window units.

B. Glass: Clear, 11/16" thick insulating-glass units, with Low E3 coating on second surface and argon fill in airspace, complying with Division 08 Section "Glazing."

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1. Provide simulated divided lites (SDL) with 7/8" wide false muntins adhered to interior and exterior glass panes, in finish to match interior and exterior window surfaces.

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.5 FABRICATION

A. Fabricate fiberglass windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Double-Hung Windows:

1. Frame Width: 4-9/16"
2. Composite Sash Thickness: 1-9/16"
3. Operating sash shall tilt-in for cleaning or removal.
4. Hardware:
   a. Balance System: Coil spring block and tackle with nylon cord and glass filled nylon shoe and zinc locking clutch.
   b. Lock: High pressure zinc die-cast cam lock and keeper, phosphate coated and electrostatically painted; color as selected by Architect.
   c. Tilt Latches: Spring loaded latches for release of sash located at check rail; color as selected by Architect.
   d. Weatherstripping: Manufacturer’s standard at bottom sash, interlock, and jambs.

5. Insect Screen: Full screen, factory installed, with 18 by 16 charcoal fiberglass screen mesh and roll-formed aluminum frame in color selected by Architect.
6. Basis of Design Product: Elevate Double Hung Windows by Marvin or equal.

C. Awning Windows:

1. Frame Depth: 4-9/16"
2. Composite Frame Thickness: 1-5/16"
3. Composite Sash Thickness: 1-9/16"
4. Hardware:
   a. Hinges: Concealed stainless steel track and injection molded shoe.
   b. Lock: Multipoint locking mechanism actuated from a single point of operation, concealed, with only the actuator handle and escutcheon visible; color as selected by Architect.
   c. Handle: Die cast detachable folding handle; color as selected by Architect.
   d. Roto Gear Operator: E-Gard™ coated hinge arm and housing mechanism.
   e. Weatherstripping: Manufacturer’s standard at frame and sash perimeter.

5. Insect Screen: Factory installed, with 18 by 16 charcoal fiberglass screen mesh and roll-formed aluminum frame in color selected by Architect.
6. Basis of Design Product: Elevate Awning Windows by Marvin or equal.

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D. Mullions: Provide mullions and cover plates as shown, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. Provide manufacturer's standard finish to match window units.

E. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Provide manufacturer's standard finish to match window units. Provide subframes capable of withstanding design loads of window units.

F. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze fiberglass windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.

G. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.6 FIBERGLASS FINISHES

A. Urethane Paint Finish: Manufacturer's standard factory baked on acrylic urethane finish, on the exterior surfaces, complying with AAMA 624-10 and paint manufacturer's written specifications for cleaning and painting.

1. Color: As selected by Architect from manufacturer's full range.

2.7 WOOD FINISH

A. Manufacturer’s standard paint finish, in white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

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1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085413

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:
   a. Swinging doors

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 08 Section "Hollow Metal Doors and Frames" for factory prefitting and factory premachining of doors and frames for door hardware.
2. Division 08 Section “Flush Wood Doors” for factory prefitting and factory premachining of doors for door hardware.
3. Division 08 Section "Polyester Faced Doors and Frames" for factory prefitting and factory premachining of doors and frames for door hardware
4. Division 26 Sections for electrical power, wiring and all final connections.

C. Products furnished but not installed under this Section include:

1. Cylinders and cores for locks on access doors.

1.2 SUBMITTALS

A. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

B. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
   h. Keying information.

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2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

C. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. System schematic.
   b. Point-to-point wiring diagram.
   c. Riser diagram.
   d. Elevation of each door.

2. Detail interface between electrified door hardware and fire alarm, access control and security system.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced Door and hardware Institute, Architectural Hardware Consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation and who shall review the schedule for overall coordination of hardware.

1. Require supplier to meet with Owner to finalize functions of locking devices, keying requirements and to obtain final instructions in writing.
2. Hardware schedule shall be prepared and sealed by AHC.

C. Regulatory Requirements: Comply with provisions of the following:

1. Comply with Americans with Disabilities Act (ADA), “Accessibility Guidelines for Buildings and Facilities (ADAAG),” and ANSI A117.1-17 , as follows:

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a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:
   1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
c. Thresholds: Not more than ½ inch (13 mm high). Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
   c. Thresholds: Not more than 1/2 inch (13 mm) high.

D. Fire-Rated Doors and Emergency-Exit Openings: Provide door operators that comply with NFPA 80 requirements for doors as emergency exits and that do not interfere with fire ratings.

E. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. UL Standard: Comply with UL 325.

H. Function and Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.” Incorporate function and keying conference decisions into final hardware and keying schedule after reviewing door hardware functions and keying system including, but not limited to, the following:

   1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2. Preliminary key system schematic diagram.
   3. Address for delivery of keys.

1.4 PRODUCT HANDLING

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A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.5 PROJECT CONDITIONS

A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

C. All electrical equipment modifications to fire doors and frames shall be performed in the factory; field modifications are not permitted

1.6 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

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C. Warranty Period: From date of Substantial Completion, unless otherwise indicated.:

1. Closers: Ten (10) years.
2. Locksets: Three (3) years
3. Exit Devices: Three (3) years
4. All other Hardware: Two (2) years.

1.7 MAINTENANCE AND TRAINING

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products and manufacturers as listed in "Schedule of Acceptable Manufacturers and Products" included at end of this section.

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated, or equivalent product approved by the Architect.

2.3 MATERIALS AND FABRICATION

A. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

B. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

C. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work

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adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

1. Thru-bolting of hardware will only be permitted where required by NFPA 80, door assembly listing requirements, and the door assembly manufacturer's installation instructions. Fasteners for closer, exit devices and similar hardware that are exposed on opposite face of door from unit will not be permitted.

2.4 HINGES, BUTTS

A. Templates: Provide only template-produced units for hinges at new frames. Provide units to match existing frame mortises where frame is being re-used.

B. Screws: Provide Phillips flat-head screws complying with the following requirements:

1. For metal doors and frames install machine screws into drilled and tapped holes.
2. For wood doors and frames install wood screws.
3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
4. Finish screw heads to match surface of hinges.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Out-Swing Exterior Doors: Nonremovable pins.
2. Out-Swing Corridor Doors: Nonremovable pins.
3. Interior Doors: Nonrising pins.
4. Tips: Flat button and matching plug, finished to match leaves.

2.5 LOCK CYLINDERS, CORES AND KEYING

A. Keying System: Provide keying system as selected by Owner; coordinate with Owner's requirements.

B. Equip locks with cylinders for interchangeable-core 7-pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.

1. Furnish final cores and keys for installation by Owner.

C. Metals: Construct lock cylinder and core parts from brass or bronze, stainless steel, or nickel silver.

D. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
2. Design master key system allowing for 300 percent expansion.

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E. Key Material: Provide keys of nickel silver only.

F. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

1. Deliver keys to Owner.

2.6 LOCKS, LATCHES AND BOLTS

A. Locksets and Latchsets: Extra-heavy-duty lever bored lockset with interchangeable core as scheduled. Lockset and cores shall be of the same manufacturer to maintain complete lockset warranty.

B. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.
2. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
3. Provide dust-proof strikes for foot bolts, except where special threshold construction provides nonrecessed strike for bolt.
4. Provide roller type strikes where recommended by manufacturer of the latch and lock units.

C. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

D. Flush Bolt Heads: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

2.7 EXIT DEVICES

A. 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.

B. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

C. Outside Trim: Lever type of material and finish to match locksets, unless otherwise indicated. Match design for locksets and latchsets.

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D. Through Bolts: DO NOT through bolt exit devices and trim on doors. Prepare doors with reinforcing and blocking to receive hardware.

2.8 PUSH/PULL UNITS

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.

B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation, thru-bolted for matched pairs but not for single units.

2.9 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, provide non-sized closers for all units.

B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA provisions for door opening force and delayed action closing.

C. Piston: Minimum 1-1/2" diameter one piece steel.

D. Provide all parallel arm closers with one piece forged extra duty arms or 3/8-inch (9 mm) thick stamped solid steel main and one piece forged or 5/16-inch (8 mm) thick stamped solid steel forearm with bronze bushings.

1. Provide spring cushion arms at all exterior doors, and where indicated.
2. Provide standard stop arms at all parallel arm closers scheduled for interior doors where a wall or floor stop is not feasible, and where indicated.
3. Provide only handed closers.
4. Provide only heavy-duty closers recommended by manufacturer for instructional applications. Standard weight products are not acceptable.

E. Provide all regular arm closers with forged or stamped steel mainarm.

F. Provide heavy-duty steel stud shoulder bolts (including main arm and forearm connection) at all regular arm, hold open arm, built-in stop arm, and hold open / built-in stop closers.

G. Provide exterior closers with all weather hydraulic fluid, suitable from 120°F to -35°F without adjustment.

H. Provide closers with powder coat finish on body, arm and plate adapter, or corrosion inhibitor primer and sprayed finish coat.

I. Provide grey resilient parts for exposed bumpers.

2.10 DOOR TRIM UNITS

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A. Fabricate protection plates the width of single leaf doors less 1-1/2-inches, and width of door leaf less 1" for pairs of doors, to yield a uniform reveal. Provide on push side by height indicated.

1. Metal Plates: Stainless steel , 0.050 inch (U.S. 18 gage).

2.11 MONITOR SWITCHES (DOOR CONTACTS), CARD READERS, SECURITY LOCKSETS, ELECTRIC STRIKES, PUSHBUTTON OPERATORS

A. Description: See schedule for size and style requirements. Coordinate voltage with Electrical Contractor as required.

2.12 SMOKE SEALS

A. General: Provide continuous smoke seals on doors where indicated or scheduled.

B. Automatic Door Bottoms (Drop Seal): Provide fully mortised type with silicon gasket and clear satin anodize finish on metal portions.

C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled, based on testing according to UL 1784.

D. Fire-Labeled Gasketing: Assemblies complying with NFPA 80-1999 that are listed and labeled, based on testing according to UL 10B or NFPA 252.

2.13 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weatherstripping on exterior doors and interior doors where indicated or scheduled. Provide noncorrosive fasteners.

B. Weatherstripping at Jambs and Heads: Provide brush type insert and extruded aluminum with anodized finish retainer strips, surface applied, of design and size scheduled.

C. Weatherstripping Sweep: Provide sweep consisting of brush type insert and extruded aluminum with anodized finish housing, surface applied, of design and size scheduled.

2.14 THRESHOLDS

A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.

B. Thresholds: Not more than ½ inch (13 mm high). Bevel raised thresholds with a slope of not more than 1:2.

2.15 HARDWARE FINISHES

A. Provide finishes as scheduled.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of door hardware.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before installation of electrified hardware

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. All doors with lever trim shall have hardware mounted at heights required by ADA (Americans with Disabilities Act) regulations.
2. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
3. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Pre-drill and countersink doors, frames and units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Hand tighten screws and fasteners, use of power driven tools must be limited to preliminary driving screws if permitted by door and hardware manufacturer.

F. Replace doors damaged by improper hardware installation.

G. Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

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H. Set thresholds for exterior doors in full bed of sealant specified in Division 7 Section "Joint Sealant."

3.3 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Adjust door closers in accordance with manufacturer’s instructions for proper door closer adjustment for spring power, backcheck, closing and latching speed.

C. Clean adjacent surfaces soiled by hardware installation.

D. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

E. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE SCHEDULESCHEDULED HARDWARE SETS

GENERAL NOTES:

1. Doors hardware shall not prohibit exiting from spaces.
2. Provide hardware finishes above unless noted otherwise for a specific set or door.
3. Provide all required installation accessories and options necessary for complete installation of each hardware component, to ensure proper operation of the product.
4. Coordinate all hardware components for each door leaf for overall compatibility.
5. Through-bolting of hardware is not permitted, coordinate all blocking requirements with door manufacturer.

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6. Provide all interior doors with wall stops, one per leaf; provide floor type as required when wall stop not feasible. Specific stops scheduled are exceptions to this.
7. Provide thresholds where indicated on drawings.
8. Provide 3 silencers per single door and 2 silencers per pair doors except omit on weatherstripped and smoke and sound sealed doors.
9. Where door closers are scheduled, provide parallel or standard arm closers placed on the least conspicuous side of the door, unless noted otherwise.
10. Provide cylinders with final cores for access doors as required; coordinate with access door specification section.
11. Provide rain drips at all exterior steel doors not under cover.
12. Provide specified smoke seal at perimeter for all rated openings on corridor walls and at stairwell doors. In addition, provide specified smoke astragal seal at all pairs of doors at rated openings on corridor walls as required by door manufacturer to meet smoke sealing requirement.
13. Furnish hardware for aluminum doors (field apply closer) to manufacturer's plant for installation
14. Functions: The lockset/exit device function specified is for BIDDING ONLY. Review all lock and exit device functions with Owner prior to submission of door schedule.
15. The Door Schedule specifies some products for aluminum clad wood doors and polyester faced doors in this Section to ensure one manufacturer of exit devices, locksets, and closers throughout the Project. These items must match throughout the building regardless of who supplies them.

See Attached DOOR HARDWARE SETS

BEDFORD FIRE HEADQUARTERS
DOOR HARDWARE SETS - ISSUED FOR BID 12.1.20

General Notes:

(1) Provide heavy duty ball hinges at all solid core doors.
(2) Provide st. stl hinges at all doors located at exterior or unconditioned spaces.
(3) See elec. dwgs. for doors with electrical requirements for security/access elements.
(4) Provide all Fire rated componets at fire rated doors as noted on door schedule.
(5) 1 1/2 Pair hinges for 7'-0" doors & 2 Pair at 8'-0" doors or as noted.
(6) Provide Power supplies for all equipment specified
(7) All access control devices to be connected to EM power & Fail safe
(8) Alarm system & door monitoring contacts are shown on security documents.
(9) Functions as show on Hardware sets notes
(10) All Electromechanical lock set doors to be coordinated with Electric Strike
(11) See Security Documents for balance of scope of Security Hardware and alarm scope
(12) All Hardware Fishes shall be US26D unless otherwise noted
(13) All hardware must have interchangable cores and be set up for master/sub - key system - see specifications
(14) New door assemblies in fire-resistance rated corridors shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test
(15) New door assemblies in fire-resistance rated corridors shall meet the requirements for smoke and draft control door assemblies, tested for air leakage in accordance with UL 1784.
(16) in all electrified sets listed if a fire rated door electrified hardware must be fail secure a in such cases provide push button reqest to exit - SDC - 422A w/ ADA symbol w/ power supply as per NFPA 80

Set No. 1- Entry Lockset Set - Single Marvin Comm. Door- FOB Access - w/ Panic Hardware

1 Mortise rim and Panic Bar set	Marvin Supplied
Commercial ADA Sill	Marvin Supplied
Mag Lock	Assa Abloy - Alarm Cotrols - 600s
Closer	Marvin Supplied
1 1/2 Pair hinges	Marvin Supplied
Kick Plates both sides each leaf	Marvin Supplied
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
Push Button request to exit	SDC - 422A w/ ADA symbol

Card FOB / intercom / mag lock w/ power supplies
connect to fire alarm - fail safe see note 16

Set No. 2- Entry Passage Set - Single Door

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
Kickplate both sides of door	

Set No. 3- Entry Lockset Set - Single FOB Access - w/ Panic Hardware
Galvannealed Frame and Door

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Electric Strike	Von Duprin 6400 series
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
Push Button request to exit	SDC - 422A w/ ADA symbol
Card FOB / intercom w/ power supply	
connect to fire alarm - fail safe see note 16	
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
Kickplate both sides of door	

Set No. 4- Entry Lockset Set - Single FOB Access - w/ Panic Hardware

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Electric Strike	Von Duprin 6400 series
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
Push Button request to exit	SDC - 422A w/ ADA symbol
Card FOB w/ power supply	
connect to fire alarm - fail safe see note 16	

Set No. 5- Double Acting Single Door
Galvannealed Frame and Door - Apparatus Bay

2 Push Plates	
1 Pair 180 degree hinges	Mckinney WS04 (US26D) / Mckinney 598S - US26D
double acting hinges	Mckinney 3001 Ajax Double Acting Horiz. Spring Hinge floor mtd.
Wall Stops	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
Edge Sweeps	Zero Neoprene Gasket
Door Bottom Sweep	Neoprene Door Attached Sweep
Large Kickplates both sides of door	

Set No. 6- Entry Lockset Set - Single FOB Access - w/ Panic Hardware
Galvannealed Frame and Door

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Electric Strike	Von Duprin 6400 series
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
Push Button request to exit	SDC - 422A w/ ADA symbol
FOB w/ power supply	
connect to fire alarm - fail safe see note 16	
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
Kickplate both sides of door	

Set No. 7- Lockset Set - Single - FOB Access

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Electric Strike	Von Duprin 6211 series
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
FOB w/ power supply	
connect to fire alarm - fail safe see note 16	

Set No. 8- Lockset Set - Single - FOB Access

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Electric Strike - Fail Safe	Von Duprin 6211 series
FOB w/ power supply	
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
connect to fire alarm - fail safe see note 16	

Set No. 9- Lockset Set - Single - FOB Access
Galvannealed Frame and Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Electric Strike	Von Duprin 6211 series
FOB w/ power supply	
Closer	LCN-2030 Concealed Closer
1 1/2 Pair hinges	Hagar/US26D
Silencer	Ives SR64
Door Bottom Seal	Zero - Surface Mounted 365
connect to fire alarm - fail safe see note 16	

Set No. 10 - Interior Fire Stair Doors
Galvannealed Frame and Door

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Closer	LCN-2030 Concealed Closer
1 1/2 Stainless Steel Pair hinges	Hagar/US26D
Silencer	Ives SR64
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 10a - Interior Hallway Passage

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Closer	LCN-2030 Concealed Closer
1 1/2 Stainless Steel Pair hinges	Hagar/US26D
Silencer	Ives SR64
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 11- Passage Set - Single Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 11a- Passage Set - Single Door
Galvannealed Frame and Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 12 - Passage Set - Single Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 13- Passage Set - Single Door - Galvannealed Frame and Door

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Electric Strike	Von Duprin 6400 series
Closer	LCN-2030 Concealed Closer
1 1/2 Stainless Steel Pair hinges	Hagar/US26D
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Motion Sensor	GE RCR/REX DUAL INFARED/DOPPLER Motion Detector
Push Button request to exit	SDC - 422A w/ ADA symbol
FOB w/ power supply	
Silencer	Ives SR64
Kickplate both sides of door	
Door Bottom Seal	Zero - Surface Mounted 365

connect to fire alarm - fail safe see note 16

Set No. 14- Common Area Restroom / Privacy Set - Single Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Coat Hook	Baldwin 0743 (US26D)

Set No. 15 - Push/Pull - Single Door Restrooms / Lockers

Push / Pull Hardware	Baldwin - Push 2280.150 w/ Baldwin - Pull 2552.260
	Baldwin - Push 2280.150
Closer	Sargent SG 421-CTHB-EN-AL
Kickplate	Baldwin - 6" x 30" 2001.264.0630
Silencer	Mckinney S1M
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 16 - Lockset - Single Door

1 Bored Lockset	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 17- Lockset - Single Door - Galvannealed Frame and Door

1 Bored Lockset	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Stainless Steel Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 18 - Privacy Set - Single Door -Galvannealed Frame and Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Stainless Steel Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Silencer	Ives SR64
Coat Hook	Baldwin 0743 (US26D)
Kickplate both sides of door	
Door Bottom Seal	Zero - Surface Mounted 365

Set No. 19- Not Used

Set No. 20- Not Used

Set No. 21-Small Closet - Single Door

1 dummy 1/2 set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
1 1/2 pair hinges	Hagar/US26D
2 roller catches	Rockwood #590/US26D
Silencer	Ives SR64
Floor / Wall Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D

Set No. 22- Exterior Single - Lockset
Insulated Core - Galvannealed Frame and Door -

1 Mortise / Panic Bar set	surface mounted - 99 series Von Duprin
Additional Dead Bolt	
Silencers	Mckinney S1M
Closer	Sargent SG 421-CTHB-EN-AL
1 1/2 Stainless Steel Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
Frame Drip Cap	Dorbin 101A or equal
Large Kickplate both sides of door	

DOUBLE DOORS

Set No. 23- Common Area / Passage Set - Double Door

2 Mortise / surface Panic Bar sets	surface mounted - 99 series Von Duprin
Silencers	Mckinney S1M
2 Closers	Sargent SG 421-CTHB-EN-AL
3 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Fire Rated Magnetic Hold opens	Sargent 1561 Flush Mount Electromagnetic Hold open

Set No. 24- Not Used

Set No. 25 - Lockset Set - Double Door - w/ privacy function Dr.

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
2 Closers	Sargent SG 421-CTHB-EN-AL
3 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
2 Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
automatic flush bolts w/ dust proof strike	Mckinney FB10W Wood Doors / FB06M Metal Doors
coordinator	Mckinney CSM572

Set No. 26- Lockset Set - Dbl. Door - Galvannealed Frame and Door

1 Bored set	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Silencers	Mckinney S1M
2 Closers	Sargent SG 421-CTHB-EN-AL
3 Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Silencer	Ives SR64
2 Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
automatic flush bolts w/ dust proof strike	Mckinney FB10W Wood Doors / FB06M Metal Doors
coordinator	Mckinney CSM572

Set No. 27- Small Closet - Double Door

2 dummy 1/2 sets	Sargent 1015 series w/ 'P' Lever, 'L' Rose
3 pair hinges	Hagar/US26D
2 roller catches	Rockwood #590/US26D
Silencer	Ives SR64
Floor / Wall Stop	Rockwood No. 442/US26D

Set No. 28- Double Door- Interior - FOB Access
Galvannealed Frame and Door -

1 Bored Lockset	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Mag Lock	Assa Abloy - Alarm Cotrols - 1200D
Card FOB w/ power supply	
connect to fire alarm - fail safe see note 16	
Door mounted astragal	
automatic flush bolts w/ dust proof strike	Mckinney FB06M Metal Doors
Silencers	Mckinney S1M
2 Closer	Sargent SG 421-CTHB-EN-AL
Silencer	Ives SR64
3 Stainless Steel Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Coordinator	Mckinney CSM572
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Adjustable Sill	Zero - Series 77: 105, 106 and 475
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
2 Plunger hold open	
Push Button request to exit w/ power	SDC - 422A w/ ADA symbol

Set No. 29- Double Door- Exterior - FOB Access

Galvannealed Frame and Door -

1 Bored Lockset	Sargent 1015 series w/ 'P' Lever, 'L' Rose
Mag Lock	Assa Abloy - Alarm Cotrols - 1200D
Card FOB w/ power supply	
connect to fire alarm - fail safe see note 16	
Door mounted astragal	
automatic flush bolts w/ dust proof strike	Mckinney FB06M Metal Doors
Silencers	Mckinney S1M
2 Closer	Sargent SG 421-CTHB-EN-AL
Silencer	Ives SR64
3 Stainless Steel Pair hinges	Mckinney T4A3786 Heavy Weight Hinge
Wall Stop or Overhead Stop	Mckinney WS04 (US26D) / Mckinney 598S - US26D
Coordinator	Mckinney CSM572
Aplied Weather stripping	Zero 119A
Edge Seals	Zero - 770AA Head & Jamb
ADA Sill	Zero -105,68,675 or equal
Adjustable Sill	Zero - Series 77: 105, 106 and 475
Door Sweep	Zero 328G
Door Bottom Seal	Zero - Surface Mounted 365
Frame Drip Cap	Dorbin 101A or equal
Push Button request to exit w/ power	SDC - 422A w/ ADA symbol

SPECIALTY DOORS

Set No. 30- Commercial Ovehead Apparatus Bay Doors

(8) Plan Locations

Raynor AlumaView® AV300 Series - 3" thick assembly - Full Glass Sectional Doors
Insulated and Impact Rated Glass w/ Red anodized finish
Wind Rated Assemblies to meet code
Enduracote Hardware system with springs, track and hardware coated Black
Control Hoist 2.0 Optima Drive Motor - Motor operated (w/ manual override and chain)
W/ standard LCD Control Panels - (All Door Controls to be Moisture Resistant)
Raynor supplied option Alarm contact
3" Customized Track to provide the greatest headroom possible
Head Seal, Jamb seals, Bottoom Bulb Seal
High Cycle Counter Balance System for 100,000- cycle life
Jam Locks
Wall-mounted interior controls opener
Power supply as required for key pad access
Photo Eye - safety shut-off
Electric reversing edge
(20) Universal car visor remote entry controls

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SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Interior borrowed lites, sidelights and transoms.

1.2 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

D. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:

1. Insulating glass.
2. Coated float glass.
3. Glazing sealants.
4. Fire resistive glazing

F. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of glass from one primary-glass manufacturer.

B. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer

C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

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D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252.

F. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257.

G. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
2. Safety glass includes fully tempered glass and fire-resistant glass.

H. Fire-Rated Glass: Permanently mark fire-rated glass with certification label of certification agency acceptable to authorities having jurisdiction indicating manufacturer name, test standard and fire-rating.

I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines."
2. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute.

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K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.5 PROJECT 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.6 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty on Fire Rated Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 5 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); Class 1 unless otherwise indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 COATED FLOAT GLASS

A. General: Provide coated glass complying with requirements indicated in this Article and in schedules at the end of Part 3.

B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified in schedules at the end of Part 3.

1. Basis of Design Product for Polyester Faced Doors: Solarban 70 by Vitro Architectural Glass (formerly PPG), or equal.
   a. Equal acceptable product: Viracon VNE-63.

2. Basis of Design Product for Fiberglass Windows and Aluminum Clad Wood Doors: Marvin low-E3 or equal.

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2.5 FIRE RATED GLAZING

A. Fire-Rated Glazing Product (Laminated Ceramic Glazing Material): Proprietary Category I and II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal thickness; polished on both surfaces, weighing 4 lb/sq. ft.; and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.
3. Product: "FireLite Plus Premium" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Manufacturer's standard sealants.

D. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

1. Aluminum with mill or clear-anodized finish.
2. Desiccant: Molecular sieve or silica gel, or blend of both.
3. Corner Construction: Manufacturer's standard corner construction.

2.7 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will 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.

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3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

B. Single-Component Neutral-Curing Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 50; Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.

1. Products:
   a. Dow Corning Corporation; 791.
   b. Dow Corning Corporation; 795.
   c. GE Silicones; SilPruf NB SCS9000.
   d. GE Silicones; UltraPruf II SCS2900.
   e. Pecora Corporation; 865.
   f. Pecora Corporation; 895.
   g. Pecora Corporation; 898

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

C. Glazing Tapes for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.9 GLAZING GASKETS

A. Glazing gaskets for doors and windows are specified in Division 08 Sections "Aluminum-Glazed Stile and Rail Wood Doors", “Polyester Faced Doors And Frames”, and “Fiberglass Windows.”.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

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B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Silicone elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating

2.11 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze 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 standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, 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 system.
3. Minimum required face or 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.

3.3 GLAZING, GENERAL

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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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:

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.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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 by gasket manufacturer.

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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. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and 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 just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. 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.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance 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. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. 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.

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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 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. 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 build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.8 GLASS SCHEDULE

A. Exterior Glazing:

1. Polyester Faced Doors: Provide 1 inch insulated tempered glass as follows:

a. Outboard Lite: 1/4-inch thick clear, fully tempered (Kind FT) glass, low-E coated on the second surface.
   1) Low-Emissivity Sputter Coating: Solarban 70; by Vitro Architectural Glass (formerly PPG Industries, Inc.)

b. Air Space: 1/2 inch, argon filled.
c. Inboard Lite: 1/4-inch thick clear, fully tempered (Kind FT) glass
d. Performance Characteristics:
   1) Visible Light Transmittance: Min 64%.
   2) Winter Nighttime U-Value: Max. 0.24
   3) Solar Heat Gain Coefficient (SHGC): Max. 0.27
   4) Light to Solar Gain: 2.37
   5) Outdoor Visible Light Reflectance: 12%

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2. Aluminum-Clad Stile and Rail Wood Doors: Provide 3/4 inch insulated tempered glass as follows:

   a. Outboard Lite: 1/8-inch thick clear, fully tempered (Kind FT), low-E coated on the second surface.
      1) Low-Emissivity Sputter Coating: Marvin's standard Low E3 coating

   b. Air Space: 1/2 inch, argon filled.
   c. Inboard Lite: 1/8-inch thick clear, fully tempered (Kind FT) glass.

3. Fiberglass Windows: Provide 11/16 inch insulated tempered glass as follows:

   a. Outboard Lite: Clear, fully tempered (Kind FT), low-E coated on the second surface.
      1) Low-Emissivity Sputter Coating: Marvin's standard Low E3 coating

   b. Air Space: Argon filled.
   c. Inboard Lite: Clear, fully tempered (Kind FT) glass.
   d. Performance Characteristics:
      1) Visible Light Transmittance: Min 43%.
      2) Winter Nighttime U-Value: 0.27 - 0.28
      3) Solar Heat Gain Coefficient (SHGC): 0.19

B. Interior Glazing, as Scheduled:

1. Non-Fire Rated Doors, Transoms, Sidelights and Borrowed Lights: 1/4 inch clear tempered glass.
2. Fire Rated Doors, Transoms, Sidelights and Borrowed Lights: Laminated ceramic glazing material 5/16 inches thick; "FireLite Plus Premium" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.

END OF SECTION 088000

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SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the Following:

1. Fixed, extruded-aluminum louvers.

B. Related Sections Include the Following:

1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 23 Sections for louvers that are a part of mechanical equipment.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.

1. Wind Loads: Uniform pressure (velocity pressure) of 18 lbf per sq. ft. acting inwards.

B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by

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testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

C. Samples for Verification: For each type of metal finish required.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Basis-of-Design Product: The design for each louver is based on the product named. Subject to compliance with requirements, provide either the named product or approved equivalent by one of the other manufacturers specified.
   a. Construction Specialties.
   b. Airolite Co.
   c. Reliable Metal Products.
   d. Industrial Acoustics Company.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

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C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Single Drainable-Blade Louver:

1. Basis-of-Design Product: Construction Specialties, Inc.; Model A4097.
2. Louver Depth: 4-inches (100 mm).
3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm).
4. Mullion Type: Fixed.
5. Performance Requirements:

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a. Free Area: Not less than 8.07 sq. ft. (0.741 sq. m) for 48-inch- (1.2 mm) wide by 48-inch (1.2 mm) high louver.
b. Percent Free Area: 50.4
c. Point of Beginning Water Penetration: Not less than 1040 fpm (5.28 m/s).

6. Sizes: Refer to Contract Drawings for sizes, configurations, and locations.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening. NO Insect screening allowed.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

2.6 BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 1 inch (25 mm).
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: As selected by Architect.
7. Attach blank-off panels with clips.

2.7 FINISHES, GENERAL

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A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   a. Color(s): As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

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E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

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SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 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.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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 E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: 1 hour and 2 hours as indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

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1. Depth: 2-1/2 inches (64 mm), 4 inches (102 mm) and 6 inches (152 mm) as indicated on the Partition Type Drawing.
2. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm) long and matching studs in depth.
1. Minimum Base-Metal Thickness: Matching steel studs.

E. Room-Side Finish: As indicated.

F. Shaft-Side Finish: Gypsum shaftliner board, moisture- and mold-resistant Type X.

G. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

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

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
b. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
c. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
d. American Gypsum; Shaft Liner.
2. Thickness: 1 inch (25.4 mm).
3. Long Edges: Double bevel.

C. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Lafarge North America, Inc.; Firecheck Moldcheck Type X Shaftliner.
b. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
c. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.
2. Thickness: 1 inch (25.4 mm).
3. Long Edges: Double bevel.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

D. Gypsum Board: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
1. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

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B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool, or rock wool; Provide mineral-fiber SAFB.

F. Acoustical Sealant: As specified in Section 079200 "Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

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1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch (0.84-mm) minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
   1. Install control joints on 30 foot maximum centers, for all partitions, at locations indicated, and as detailed. Align control joints with door frames wherever possible, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

H. Cant Panels: At projections into shaft exceeding 4 inches (102 mm), install 1/2- or 5/8-inch- (13- or 16-mm-) thick gypsum board cants covering tops of projections.
   1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft wall framing.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling or attic spaces.
   2. Be repeated at intervals not exceeding 30 feet (914 mm) measured horizontally along the wall or partition.
   3. Include lettering not less than 0.5 inch (12.7 mm)) in height, incorporating the followings wording: “FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS,” or other wording to reflect the wall type as indicated on the Code Summary Drawings.

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3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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 092116.23

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:
   a. Minimum Base-Metal Thickness: 0.0296 inch, 20 ga. (0.752 mm).
   b. Depth: As scheduled on Drawings for each location.

C. Slip-Type Head Joints: Provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs

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friction fit into top runner and with continuous cold rolled channel bridging attached to each stud located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) ClarkDietrich; MaxTrak Slotted Deflection Track
      2) Steel Network Inc. (The); VertiClip SLD Series.
      3) Telling Industries; True-Action™ Slotted Track.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch, 20 ga. (0.84 mm).

E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm) unless otherwise indicated.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
2. Depth: 7/8 inch (22.2 mm) unless otherwise indicated.

G. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. 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: 3/4 inch (19 mm) unless otherwise indicated.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, 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.

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2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, 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. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
   a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm) unless otherwise indicated on Drawings.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Runners: ASTM C 645.
   a. Minimum Base-Metal Thickness: 0.018 inch, 25 ga. (0.45 mm).
   b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
   a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).

4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
   a. Configuration: Asymmetrical or hat shaped.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, 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.

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b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, 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 (3.2 mm) 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.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

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3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

E. Cutting, Notching and Boring Holes in Nonstructural Steel Wall Framing:

1. Flanges and lips of nonstructural steel wall studs shall not be cut or notched.
2. Holes in webs of nonstructural steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed 1-1/2 inches (38 mm) in width or 4 inches (102 mm) in length, and the holes shall not be spaced less than 24 inches (610 mm) center to center from another hole or less than 10 inches (254 mm) from the bearing end.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs at 16 inches (406 mm) o.c. unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

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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.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   a. Sound Isolation pads shall be installed as a continuous resilient layer separating the base and/or top plate of the stud wall assembly from the non-isolated floor and/or ceiling deck where shown on drawings. Wallboard shall be cut and installed to allow a 1/4" to 3/8" gap at the isolation joint for the installation of resilient non-hardening acoustical caulking.

6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Install steel studs used as furring with clip angles at midpoint of wall span. Install additional clips to limit deflection to L/240 for walls finished with gypsum wall board and L/360 for walls finished with tile or plaster when subject to 5 psf (239 Pa) lateral load.

E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

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.

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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 (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Cement board.
3. Sound-attenuation blankets

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: In addition to the items listed below, submit a completed LEED Environmental Product Declaration Form, LEED Leadership Extraction Practices Certification Form, LEED Product Disclosure and Optimization Certification Form, and LEED v4 Low Emitting Materials Certification Form, as applicable, in accordance with Section 013300 “Submittal Requirements – LEED v4 BD+C”.

1. Product Data: For gypsum board, cement board and finishing materials, adhesives and sealants, and sound attenuation insulation indicating VOC content.
2. Laboratory Test Reports: For gypsum board, cement board and finishing materials, adhesives and sealants, and sound attenuation insulation indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration (EPD): For each product

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

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1. Install mockups for the following:
   a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 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.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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 E 119 by an independent testing agency.

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

C. VOC Content: Gypsum board and cement board panels, finishing materials, adhesives and sealants shall have VOC content meeting the requirements of Section 018117 “Low Emitting Material Requirements”.

D. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

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Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

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, provide products by one of the following:
   1. CertainTeed Corp.
   2. Georgia-Pacific Gypsum LLC.
   3. Lafarge North America Inc.
   4. National Gypsum Company.
   5. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Where drawings indicate regular type 5/8 inch, provide 5/8 inch Type X indicated below.
   3. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch
   2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 1/2 inch.
   2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces, in 5/8 inch thickness unless otherwise indicated, with tapered edges; panels shall be classified as Type X
   1.
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   3. Products: Subject to compliance with requirements, provide one of the following or equal:
      a. National Gypsum Company; Type XP/PR
      b. United States Gypsum Co.; Mold Tough

F. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   4. Performance Data:
      a. Surface Abrasion: ASTM C1629. Classification Level 2

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b. Surface Indentation: ASTM C1629. Classification Level 1
c. Soft-body Impact Test: ASTM C1629. Classification Level 1

5. Products: Subject to compliance with requirements, provide one of the following or equal:
   a. Protecta AR 100 Type X with Mold Defense; Lafarge North America Inc.
   b. ProRoc Gypsum Board Panels; Certainteed, Division of BPB.

G. Flexible Gypsum Board: ASTM C 1396/C 1396M. 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 (6.4 mm).
   2. Long Edges: Tapered.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
   1. Products: Subject to compliance with requirements, provide one of the following or equal:
      a. CertainTeed Corp.; ProRoc Type C.
      b. Lafarge North America Inc.; Firecheck Type C.
      c. National Gypsum Company; Gold Bond Fire-Shield C.
      d. USG Corporation; Firecode C Core.

   2. Thickness: 5/8 inch, unless otherwise indicated.
   3. Long Edges: Tapered.
   4. Provide where required by UL Design or NER 258.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; FiberCement BackerBoard.
      b. Custom Building Products; Wonderboard.
      c. James Hardie Building Products, Inc.; Hardiebacker 500.
      d. National Gypsum Company, Permabase Cement Board.
      e. USG Corporation; DUROCK Cement Board.

   2. Thickness: 1/2 inch or 5/8 inch as indicated.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia Pacific; DensShield.
      b. National Gypsum Company, Gold Bond® BRAND eXP® Tile Backer.
      c. USG Corporation; DUROCK Glass-Mat Tile Backerboard.

   2. Thickness: 1/2 inch or 5/8 inch as indicated

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3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized-coated steel sheet or rolled zinc
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. Expansion (control) joint.
      f. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified
   4. Products: Provide Contura curved drywall trim by Gordon Inc. for locations indicated on the Drawings, in sizes required.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. 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, 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 factory mixed drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use factory mixed drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

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D. Joint Compound for Tile Backing Panels:
   1. Cementitious Backer Units: As recommended by backer unit manufacturer.
   2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Provide mineral-fiber SAFB where required by the UL assembly.

E. Acoustical Joint Sealant: As specified in Section 079200 “Joint Sealants”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

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 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

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.

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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 (1.5 mm) 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, except floors. 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 C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   1. Refer to Section 079200 for additional requirements.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces unless otherwise indicated.
   2. Ceiling Type: Ceiling surfaces.
   3. Abuse-Resistant Type: As indicated on Drawings.
   4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
   5. Type C: Where required for specific fire-resistance-rated assembly indicated.

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6. Flexible Type: Apply in double layer at curved assemblies

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 vertically (parallel 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.
   b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
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 (400 mm) 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.

A. 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 recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

B. 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 (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.

B. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile, other than shower and tub areas. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

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C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING 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 C 840 and in specific locations approved by Architect for visual effect.
   1. Install control joints on 30 foot maximum centers, for all partitions, at locations indicated, and as detailed. Align control joints with door frames wherever possible, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
   2. Install control joints at 50 foot maximum centers, with areas not to exceed 2,500 sq. ft. for all ceiling areas, at locations indicated, and as detailed.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use where indicated.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

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 C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 4: At all panel surfaces that will be exposed to view unless otherwise indicated.
   4. Level 5: Provide Level 5 finish at all areas where wall washed lighting is indicated and at surfaces scheduled to receive gloss paint, and elsewhere specifically indicated on Drawings and schedules.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

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F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions

3.7 IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling or attic spaces.
   2. Be repeated at intervals not exceeding 30 feet (914 mm) measured horizontally along the wall or partition.
   3. Include lettering not less than 0.5 inch (12.7 mm)) in height, incorporating the followings wording: “FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS,” or other wording to reflect the wall type as indicated on the Code Summary Drawings.

3.8 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 092900

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SECTION 093100 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Porcelain tile
2. Porcelain ceramic mosaic tile
3. Trim and edge accessories.
4. Waterproof membrane for tile installations
5. Waterproof membrane for shower floors and walls
6. Stone thresholds.

B. Sealing of expansion, contraction, control, and isolation joints in tile surfaces is specified in Division 07 Section "Joint Sealant."

1.2 ACTION SUBMITTALS

A. Product data for each type of product specified.

B. Samples of each color of tile, marble threshold, or accessory to be provided, for verification purposes.

C. Samples of grout demonstrating full range of colors available, for initial selection purposes.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

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D. Unit Mock-up: Provide mock-up on a board min. 2' x 2' in size, one for each different tile and grout color to be provided in the work; for final approval of grout color before ordering grout.

E. In-Place Mock-up: Prepare mock-ups of types indicated below following requirements of this section. Reprepare mock-ups as many times as required by Architect until satisfactory result is obtained, as judged solely by Architect. Obtain Architect's approval of visual qualities before proceeding with work. Protect approved mock-ups until all work has been completed. Approved mock-ups will represent the minimum standard of acceptability for each portion of the work.

1. Provide in-place sample approximately 8'-0" by 8'-0" in size of each different tile installation, located where directed by Architect.

1.5 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 requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturers: The design for each tile type and other material specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following manufacturers:

1. Tile:
   a. American Olean; Div. of Dal-Tile International Corp
   b. Creative Materials Corp.
   c. Crossville Inc
   d. Daltile; Div. of Dal-Tile International Inc.

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e. Garden State Tile
f. Olympia Tile
g. Florida Tile Industries, Inc.
h. Mirage Granito Ceramico Spa (Mirage USA)
i. Provenza (distributed by Stone Source)
j. Stonepeak
k. Summitville Tiles, Inc.
l. United States Ceramic Tile Company
m. Floor Gres Ceramiche (distributed by Stone Source)

2. Mortars and Grouts:
   a. Bostik Construction Products Div. (Hydroment)
   b. Laticrete International Inc.
   c. Mapei Corp.
   d. TEC Specialty Construction Brands Inc.

3. Waterproofing Membranes: The Noble Co.
4. Termination, Trim and Transition Strips: Schluter

2.2 PRODUCTS, GENERAL

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.

   1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

   1. Match color, texture, and pattern indicated by reference to manufacturer's standard designations for these characteristics.
   2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

E. Large Format Tiles: Large format tiles are defined to be tiles with any one single side larger than 15".

2.3 TILE PRODUCTS

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A. Porcelain Ceramic Mosaic Floor Tile and Wall Accent Tile: Provide factory-mounted flat tile complying with the following requirements:

1. Composition: Porcelain.
2. Wearing Surface: Honed.
3. Module Size: 2 by 2 inches
4. Sheet Size: 12" x 12"
5. Nominal Thickness: 1/3 inch.
6. Mount Type: Sheet back mounted.
7. Basis of Design Product: StonePeak “Simply Modern” collection, or equal.
8. Color: As indicated on Drawings.
9. Location: Shower floors and accent on shower walls.

B. Porcelain Floor and Wall Tile: Provide tile complying with the following requirements:

1. Composition: Porcelain.
2. Wearing Surface: Honed.
3. Module Size: 12 by 24 inches
4. Nominal Thickness: 1/3 inch.
5. Basis of Design Product: StonePeak “Simply Modern” collection, or equal.
6. Color: As indicated on Drawings for each location.

C. Porcelain Wall Tile: Provide tile complying with the following requirements:

1. Composition: Porcelain.
2. Wearing Surface: Honed.
3. Module Size: 12 by 12 inches
4. Nominal Thickness: 1/3 inch.
5. Basis of Design Product: StonePeak “Simply Modern” collection, or equal.
6. Color: As indicated on Drawings for each location.

D. Trim Units: Provide tile trim units and to comply with following requirements:

1. Provide bullnose trim at tile wainscot.,
2. Provide cove base with preformed internal and external corners.

2.4 STONE THRESHOLDS

A. General: Provide stone that is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor surfaces.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.

B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241.

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1. Provide white marble thresholds.

2.5 WATERPROOFING/CRACK ISOLATION FOR TILE INSTALLATIONS

A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. Polyethylene-Sheet Waterproofing/Shower Pan: Manufacturer's standard proprietary product consisting of nonplasticized, chlorinated polyethylene sheet, designed for mudsetting bed. Provide at all locations indicated for mud-setting.

1. Product: Provide Chloraloy manufactured by the Noble Company, or approved equal.
2. Location: Use at shower floors.

C. Polyethylene-Sheet Waterproofing/Crack Isolation: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches (1524 mm) wide by a nominal thickness of 0.030-inch (0.76 mm), composed of an inner layer of nonplasticized, chlorinated polyethylene sheet faced on both sides with laminated, high-strength, nonwoven polyester material, designed for embedding in latex-portland cement mortar and as the substrate for latex-portland cement mortar setting bed. Provide at all locations for thin-setting.

1. Products: Provide Nobleseal TS manufactured by the Noble Company, or approved equal.
2. Location: Use at all thin set tile floors in bathrooms and at shower walls.

2.6 SETTING MATERIALS

A. Portland Cement Mortar Materials: Comply with ANSI A108.1 and as specified below:

1. Portland Cement: ASTM C 150, Type I.
2. Sand: ASTM C 144.
3. Water: Potable.

B. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.
2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.

C. Medium-Bed, Latex-Portland Cement Mortar. Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of up to 3/4 inch. Provide one of the following, or approved equal:

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1. MegaLite® Ultimate Crack Prevention Large Format Tile Mortar by Custom Building Products.
2. 4-XLT by Laticrete.
3. Large Tile and Stone Mortar by Mapei

D. Latex-Portland Cement Mortar: Two component mortar system, comply with ANSI A118.4. Provide one of the following, or approved equal:

1. Laticrete 317 with Laticrete 333 additive; Laticrete International, Inc.
2. Kerabond with Keralastic; Mapei Corp.
3. Or equivalent.

2.7 GROUTING MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3. with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Grout shall be stain resistant, color fast, mold and mildew inhibiting, non-sag, suitable for joints 1/16" to ½" and sanded type suitable for installing with glazed tiles.

1. Basis of Design Product: Laticrete “Spectralock Pro Epoxy Grout” or equal.
2. Colors: As scheduled, or if not scheduled, as selected by Architect.

2.8 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated.

B. Notched Trowel: Use type recommended by tile manufacturer for setting large-format tiles, for setting bed thickness utilized.

C. Termination, Trim and Transition Strips: Provide Schluter units as scheduled or indicated on Drawings.

D. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

E. Grout Release: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Mapei “UltraCare Grout Release”.
2. Miracle Sealants Co. “511 Impregnator”

F. 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.

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G. Grout Sealers: Water-based sealer for tile for protection from stains, as follows:

1. Mapei “UltraCare Grout Sealer”.
2. Miracle Sealants Co. “511 Impregnator”

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
2. 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 before installing tile.
3. Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
4. Perform moisture test at rate of one per 2,000 sq.ft.
5. Verify that concrete substrates are within the flatness tolerances required for setting large format tiles.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.

B. Use trowelable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates and to patch and level floors as required to provide suitable substrate for tile application.

C. Remove coatings, including curing compounds, and other substances that could interfere with adhesion of tile by using a grinder, sander, or polishing machine with a heavy-duty wire brush.

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D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.

F. For large format tile thin-set with medium bed mortar, level substrate to 1/8-inch variance in 10 feet, with no more than 1/16 inch variation in 24 inches by one of the following methods:

1. Floors: Provide one of the following methods:
   a. Provide self-leveling hydraulic cement underlayment throughout project where new tile is installed.
   b. Grind concrete substrate and patch with trowelable leveling and patching compound to achieve indicated flatness.

2. Walls: Skim coat and patch wall surfaces using manufacturer approved trowel-applied cement-based compound to bring surface into acceptable tolerances.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.

B. TCNA Installation Guidelines: TCNA "Handbook for Ceramic Tile Installation"; comply with TCNA installation methods indicated.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. 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 that plates, collars, or covers overlap tile.

1. Cut and grind tile edges where they abut curved surfaces to produce a close and uniform abutting joint.

E. Jointing Pattern: Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

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1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

F. Tile Patterns: Comply with pattern indicated on drawings.

G. Expansion Joints: Provide expansion joints, control joints and pressure relieving joints of widths and at locations as per TCNA Handbook Construction #EJ171. Do not saw cut joints after installation of tiles.

1. Sealing of joints is included in Division 07 Section "Joint Sealers."

H. Apply grout release to tile surfaces prior to grouting. Prepare a small mock-up area of grout release application for Architect's approval before proceeding with application of grout release to installed tile surfaces.

I. Grout tile to comply with ANSI A108.10.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR INSTALLATION METHODS

A. Floor Tile: Install tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfloor construction, and grout types:

1. Shower Floors, Concrete subfloor, TCNA B421, (Mud set application) modified to comply with membrane manufacturer's installation instructions, details on drawings and as follows:
   a. CPE sheet membrane over sloped mortar bed and extended up walls 6"; flood test installed membrane and correct leaks and defects before installing topping mortar bed.
   b. Reinforced mortar bed 3/4" thick; ANSI A108.1A.
   c. Bond coat of portland cement paste on a mortar bed that is still plastic or latex-portland cement mortar on a cured bed.
   d. Apply grout release prior to grouting.
   e. Grout: Epoxy
   f. Location: shower floors.

2. Concrete subfloor with waterproofing/crack suppression membrane, TCNA F205 modified to comply with membrane manufacturer's installation instructions, details on drawings and as follows:

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a. Bond Coat for Membrane: Medium-Bed, Latex-Portland Cement Mortar, ANSI A108.5 over subfloor.
b. Sheet membrane over bond coat, extend up walls 4 inches
c. Bond Coat for Tile: Medium-Bed, Latex-Portland Cement Mortar—ANSI A108.5 over membrane
d. Grout: Epoxy.
e. Provide at bathrooms.

B. Joint Widths: 3/16" (overlap shall not exceed 33% when installing tile with a length 15" or greater in a staggered brick-joint or running bond pattern).

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

D. Stone Thresholds: Install stone thresholds at tile transitions at restrooms. Allow for bevel/chamfer as required. Set in same type of setting bed as abutting field tile unless otherwise indicated. Sealant is specified in Section 079200.

3.6 WALL INSTALLATION METHODS

A. Wall Tile: Install tile to comply with requirements indicated below for setting-bed methods, TCNA installation methods related to subsurface wall conditions, and grout types:

1. Gypsum Board - TCNA W243, and as follows:
   a. Bond Coat for Tile: Latex-portland cement mortar, ANSI A108.5 over gypsum board.
   b. Grout: Epoxy.

2. Shower Walls, Solid Backing, TCNA B415 and W244, modified to comply with membrane manufacturer's installation instructions, details on drawings and as follows:
   a. Bond Coat for Membrane: Medium-Bed, Latex-Portland Cement Mortar, ANSI A108.5 over cement board.
   b. Sheet membrane over bond coat.
   c. Bond Coat for Tile: Medium-Bed, Latex-Portland Cement Mortar, ANSI A108.5 over sheet membrane.
   d. Grout: Epoxy

B. Joint Widths: 3/16" (overlap shall not exceed 33% when installing tile with a length 15" or greater in a staggered brick-joint pattern).

3.7 CLEANING AND PROTECTION

A. Cleaning: Upon 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. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after

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installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.

1. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093100

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceilings consisting of

1. Acoustical panels and exposed suspension systems.

B. Related Sections include the following:

1. Acoustical sealants are specified in Division 07 Section “Joint Sealants”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product specified

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1:100

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings and trim, for each color and system type required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

B. Research/Evaluation Reports: Evidence of acoustical panel ceiling's and components' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

C. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
   a. Flame Spread: 25 or less.
   b. Smoke-Developed Index: 450 or less

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges, soiling panels or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

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B. Acoustical Panels for Acoustical Panel Ceiling: Where this designation is indicated, provide acoustical panels complying with the following:

1. Classification: Panels fitting ASTM E 1264 for Type III, wet-formed mineral fiber with painted finish; Form 2, water felted.
2. Pattern: Panels fitting ASTM E 1264 pattern designation (description) C (perforated, small holes) and E (lightly textured).
3. Color: White.
4. Surface: Factory-applied latex paint
5. Light Reflectance Coefficient: Not less than LR 0.81.
6. Noise Reduction Coefficient: 0.50
7. Ceiling Attenuation Class: 35
8. Fire Rating: Class A
9. Sag Resistance Treatment: Armstrong HumiGuard Plus
10. Anti-Mold and Mildew Treatment: BioBlock
11. Low VOC Emissions: GREENGUARD Gold Certified
12. Warranty: 30 year
13. Edge Detail: Angled tegular
14. Thickness: 5/8 inch.
15. Size: 24 by 24 inches.
16. Basis of Design Product: Armstrong Dune Tegular #1774, or equal.

2.2 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Suspension System for Acoustical Panel Ceiling: Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z120) coating designation, with prefinished 15/16-inch-(24-mm-) wide metal caps on flanges; other characteristics as follows:

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
3. Face Design: Flush face.
4. Cap Material: Steel sheet.
5. Cap Finish: Manufacturer's standard factory-applied painted finish in white.
6. Basis of Design Product: Armstrong Prelude XL or equal.

C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

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

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to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish and color as that used for exposed flanges of suspension system runners.

2.3 ACOUSTICAL SEALANT

A. Refer to Division 07 Section “Joint Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and 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 other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

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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 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

3.4 CLEANING

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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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096500 - RESILIENT FLOORING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Rubber sheet flooring.
2. Luxury vinyl tile.
3. Rubber wall base.
4. Resilient flooring accessories.
5. Resilient stair accessories.

1.2 ACTION SUBMITTALS

A. Product data for each type of product specified.

B. Samples for verification purposes in form of actual flooring or sections of accessories for each color and pattern specified.

1. For heat-welding bead, manufacturer's standard-size samples, but not less than 9 inches (230 mm) long, of each color specified.

C. Shop Drawings: Indicate decorative pattern layout, if any. Show location of seams and edges. Indicate location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutout locations.

1.3 INFORMATIONAL SUBMITTALS

A. Maintenance data for resilient flooring and accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who is competent in the technique required by sheet flooring manufacturer for heat-welding seams.

B. Single-Source Responsibility for Floor Tile and Accessories: Obtain each type, color, and pattern of tile and accessory from a single source; all stair accessories shall be from one manufacturer.

C. Single-Source Responsibility for Sheet Flooring and Accessories: Obtain each type, color, and pattern of sheet floor covering specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

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D. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
2. Smoke Density: Less than 450 per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient materials on flat surface in dry space protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

B. Move floor coverings and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive resilient flooring for at least 72 hours prior to installation, during installation, and for not less than 72 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

B. Moisture Testing of Concrete Substrates: Perform moisture tests recommended by manufacturer and as follows. Do not install flooring if subfloor moisture emission rate exceeds indicated amounts.

1. Calcium Chloride Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed the following maximum moisture-vapor-emission rate, unless otherwise allowed by adhesive manufacturer:
   a. Rubber Sheet: Not more than 8 lb/1000 sq. ft./24 hours.
   b. Luxury Vinyl Tile: Not more than 8 lb/1000 sq. ft./24 hours.

2. Moisture Meter Testing: Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have relative humidity level measurement acceptable to flooring material manufacturer.
   a. Rubber Sheet: 90% RH
   b. Luxury Vinyl Tile: 90% RH

3. Testing Procedures: Perform calcium chloride or moisture meter tests as required by floor topping and resilient tile manufacturers.

C. Do not install flooring or accessories until they are at the same temperature as the space where they are to be installed.

D. Close spaces to traffic during flooring installation.

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1.7 SEQUENCING AND SCHEDULING

A. Install flooring and accessories after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Tiles:
   a. Armstrong World Industries
   b. Mannington
   c. Mohawk Group
   d. Shaw Hard Surface
   e. Tarkett

2. Base and Other Accessories:
   a. Endura
   b. Flexco
   c. Roppe
   d. Johnsonite

3. Rubber SheetTiles and Stair Treads:
   a. Endura Large Tile
   b. Nora
   c. Johnsonite
   d. Roppe

2.2 PRODUCTS, GENERAL

A. Colors, Textures, and Patterns: Provide tile, sheet goods and accessories in color, texture and pattern to match specified products. Colors and patterns indicated by reference to manufacturer's name and designations are for color and pattern identification only and are not intended to limit selection of other manufacturer's products with similar colors and patterns. If no colors or patterns are indicated, provide color(s) and pattern(s) as selected by Architect from manufacturer’s standards.

B. Resilient flooring and base shall comply with RFCI FloorScore Program.

2.3 RESILIENT SHEET FLOORING

A. Rubber Sheet: Seamless homogeneous sheet rubber flooring meeting ASTM F1869, Type 1, and as follows:

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1. Width: 6 ft.
2. Length: 50 ft.
3. Thickness: 0.100 inch.
4. Surface: Smooth
5. Color: As selected by Architect.
6. Basis of Design Product: “Envire Sheet Rubber Flooring” by Roppe, or equal.

2.4 RESILIENT TILE FLOORING

A. Luxury Vinyl Tile: Luxury vinyl tile complying with ASTM F1700, Class III, Type B and as follows:

1. Basis of Design Product: Shaw Hard Surfaces “Terrain II 20 mil 5 Mm” 4110V.
2. Size: 6" w x 48" l
3. Thickness: 0.197 inches (5 mm)
4. Wear Layer Thickness: 20 mil
5. Finish: ExoGuard +
6. Color: As selected by Architect.
7. Installation: Ashlar

2.5 RESILIENT WALL BASE

A. Rubber Wall Base: ASTM F 1861, Type TP, Group 1 (solid), 4-1/4" high, 1/8" thick, smooth surface, and as follows:

1. Style: Straight (toeless) style for all carpeted areas and cove base with toe (set-on type) elsewhere
2. Profile: As selected by Architect.
3. Lengths: Coils in manufacturer's standard length.
4. Inside and Outside Corners: Preformed.
5. Products: Perceptions by Johnsonite, a Tarkett company.
6. Colors: As selected by Architect.

2.6 RESILIENT STAIR ACCESSORIES

A. Stair Treads: Rubber one-piece tread/riser combination meeting ASTM F-2169, Type TS, Class 1 and 2, Group 1 and 2, and as follows:

1. Nosing Style: Square, hinged.
2. Thickness: 3/16" tapering to 1/8" nom.
3. Tread Depth: 12-1/16 inches.
4. Riser Height: 7 inches.
5. Length: As required to fit each stair tread in one piece.
6. Surface Pattern: Round raised disc pattern.
7. Solid Rubber Colored Insert Strip: 2" wide, in contrasting color for visually-impaired.
8. Tread Color: As selected by Architect.
9. Insert Strip Color: As selected by Architect.

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10. Basis of Design Product: 98 Raised Circular Vantage Design Tread With Riser by Roppe, or equal.

2.7 MISCELLANEOUS RESILIENT ACCESSORIES

A. Color: As selected by Architect from manufacturer's full range of colors produced for accessory molding complying with requirements indicated.

B. Rubber Accessory Moldings: Provide rubber accessory molding complying with the following:

1. Product Description: Carpet edge for glue-down applications, carpet nosing, nosing for rubber tile, reducer strip for resilient flooring, and tile and carpet joiner.
2. Profile and Dimensions: As indicated or required.

2.8 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Concrete Sealer: Type recommended and approved by resilient flooring manufacturer and adhesive manufacturer to ensure proper adhesion of resilient flooring to substrate.

C. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

D. Adhesives (Cements): Products supplied by resilient flooring and accessory manufacturers, of type recommended to suit resilient products and substrate conditions

1. Use adhesives that are suitable for moisture conditions of substrate at time of installation.

E. Heat-Welding Bead: Solid-strand product of floor covering manufacturer for heat-welding seams.

1. Color and Pattern: Match color and pattern of sheet floor covering.

F. Floor Polish: Acrylic type, as recommended by flooring material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine areas where installation of flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for flooring installation and comply with flooring manufacturer's requirements and those specified in this Section.

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B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond tests recommended by flooring manufacturer.
2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

C. Concrete Moisture Emission Tests: Perform calcium chloride test or relative humidity test as per manufacturer's directions, as follows, and other tests if recommended by resilient flooring and adhesive manufacturer:

1. Perform moisture test at rate of one per 2,000 sq.ft. of new and existing floor area to be covered.
2. Report test results in writing to Architect, and Contractor within 24 hours after tests are completed. Reports of concrete moisture emission tests shall contain the Project identification name and number, date of test location of test within structure.
3. Perform additional moisture emission tests of in-place concrete when test results indicate specified moisture content has been exceeded, as directed by Architect.
   a. Repeat test one week after initial test minimally and additionally repeat test if required by field conditions to determine moisture levels in area of resilient flooring application.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. If ASTM F2170 or ASTM F1869 test results exceed the prescribed limits, a moisture mitigation product recommended by the flooring manufacturer shall be installed prior to proceeding with installation.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive flooring.

B. Use trowelable leveling and patching compounds per flooring manufacturer's directions to fill cracks, holes, and depressions in substrates and to patch and level floors as required to provide suitable substrate for flooring application.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives by using a grinder, sander, or polishing machine with a heavy-duty wire brush.

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D. Broom or vacuum clean substrates to be covered by flooring immediately before installation of flooring. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

F. Seal concrete substrates as required by moisture test results to ensure proper adhesion of resilient flooring to substrate.

3.3 SHEET FLOORING INSTALLATION

A. General: Comply with sheet floor covering manufacturer's written installation instructions.

B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting, if recommended in writing by manufacturer.

C. Lay out sheet floor coverings to comply with the following requirements:

1. Maintain uniformity of sheet floor covering direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches (150 mm) away from parallel joints in flooring substrates.
3. Match edges of sheet floor coverings for color shading and pattern at seams according to manufacturer's written recommendations.
4. Avoid cross seams.

D. Scribe, cut, and fit sheet floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

E. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.

G. Install sheet floor coverings on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.

H. Adhere sheet floor coverings to flooring substrates to comply with floor covering manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

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I. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into a seamless floor covering. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining floor covering surfaces.

J. Hand roll sheet floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.4 TILE INSTALLATION

A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls so tiles at opposite edges of room are of equal width. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in decorative pattern as indicated on drawings.

D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces and edgings.

E. Extend tiles into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.

G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.

H. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

I. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

J. Hand roll tiles where required by tile manufacturer.

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3.5 INSTALLATION OF WALL BASE AND ACCESSORIES

A. General: Install resilient accessories according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

1. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
2. Install preformed corners as per manufacturer’s directions.

C. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.6 INSTALLATION OF RESILIENT STAIR TREADS/RISERS

A. Apply resilient treads/risers to stairs as indicated and according to manufacturer’s written installation instructions.

B. Use stair-tread-nose filler, according to resilient tread manufacturer’s written instructions, to fill nosing substrates that do not conform to tread contours.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by resilient flooring manufacturer.
4. Damp-mop flooring to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by flooring manufacturer.

1. Apply protective floor polish to flooring surfaces that are free from soil, visible adhesive, and surface blemishes. Coordinate selection of floor polish with Owner's maintenance service requirements.
2. Cover flooring with undyed, untreated building paper until inspection for Substantial Completion.

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C. Clean flooring not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean flooring using method recommended by manufacturer.

1. Strip protective floor polish that was applied after completing installation prior to cleaning.
2. Reapply floor polish after cleaning.

END OF SECTION 096500

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SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Epoxy-resin, thin-set terrazzo.
2. Thin-set, precast epoxy terrazzo base.
3. Precast epoxy terrazzo stair treads and risers.
4. Epoxy-resin, thin-set terrazzo logo.

B. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete” for concrete substrate requirements.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of terrazzo, component material, and accessory specified.

B. Shop Drawings: Include terrazzo fabrication and installation requirements. Include plans, elevations, sections, component details, and attachments to other Work. Show layout of the following:

1. Divider and control- and expansion-joint strips.
2. Base and border strips.
3. Precast terrazzo jointing and edge configurations.
4. Treads and risers on metal stair substrate.
5. Abrasive strip placement.
6. Crack suppression/isolation membrane placement.
7. Terrazzo patterns and logos.
   a. Submit full size color rendering of logo proposed to be provided.
   b. Submit full-size template of logo proposed to be provided.

C. Samples for Initial Selection: National Terrazzo and Mosaic Association (NTMA) color plates showing the full range of colors available for each terrazzo type indicated.

D. Samples for Verification: Maximum of three 6-inch- (150-mm-) minimum square samples of each precast and cast-in-place terrazzo color and type required, showing the full range of color, texture, and pattern variations expected. Prepare samples of the same thickness and from the same material to be used for the Work. Provide minimum 6-inch- (150-mm-) long samples of each exposed strip item required.

1.3 INFORMATIONAL SUBMITTALS

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A. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Material Certificates: Certificates signed by suppliers or manufacturers certifying that each material complies with requirements.

C. Maintenance Data: Submit two copies of maintenance recommendations of NTMA or maintenance product members of NTMA.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer shall be a contractor member of NTMA and shall perform all work in accordance with NTMA standards.
2. Installer not a contractor member of NTMA shall have 10 years experience, completed terrazzo installations similar in material, design, and extent to that indicated for this Project, and shall submit a record of successful in-service performance.
3. Installer shall have successfully completed a minimum of 5 projects involving custom designed logos installed in terrazzo flooring.

B. Source Limitations: Obtain primary terrazzo materials through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

C. Source Limitations for Marble: Obtain each color, grade, type, and variety of marble from one source with resources to provide materials of consistent quality in appearance and physical properties without delaying the Work.

D. NTMA Standards: Comply with the National Terrazzo and Mosaic Association's (NTMA) Guide Specification and written recommendations for terrazzo type indicated, unless more stringent requirements are specified.

E. Mockups: Before installing terrazzo, construct mockups for each type and color required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before proceeding with terrazzo installation.

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5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings." Review methods and procedures related to installation including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review structural loading limitations.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review dust-control procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in suppliers' original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any. Deliver materials in a manner to prevent damage to containers and/or bags.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Storage area temperature to be between 50 deg F (10 deg C) and 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 72 hours before and during terrazzo installation. The minimum slab temperature for crack suppression system must be conditioned to 60°F before commencing installation, during installation, and for at least 72 hours after installation is complete.

B. Do not install flooring if subfloor moisture emission rate exceeds indicated amounts when tested by calcium chloride moisture test or relative humidity test, with subfloor temperatures not less than 55 deg F.

1. Calcium Chloride Moisture Test: Not more than 3 lb/1000 sq. ft./24 hours when tested according to ASTM F1869 using anhydrous calcium chloride.
2. Relative Humidity Test: Maximum 75 percent relative humidity measurement when tested according to ASTM F2170 using in-situ probes.

C. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust and migration and to separate areas from noise.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide one of the following systems or equal:

1. Crossfield Products Corp., Dex-O-Tex Division; Cheminert Terrazzo
2. General Polymers Corporation, a Sherwin Williams Company; Thin-Set Epoxy Terrazzo #1100.
3. Concord Terrazzo Company, Inc.; TERRAZZCO Groutless™ EZPour Epoxy 158
4. Key Resin Company; Key Epoxy Terrazzo #108.

2.2 MATERIALS

A. Water: Potable.

B. Marble Chips: Sizes conforming to NTMA gradation standards for mix and thickness indicated, with Ha 10 minimum abrasive-hardness value when tested according to ASTM C 241, 0.75 percent maximum 24-hour absorption rate, dust content of less than 1 percent by weight, and containing no deleterious or foreign matter. Colors as select by Architect from NTMA standard and custom colors.

C. Other Aggregates: One-sided mirror fragments.

D. Epoxy-Resin Matrix: Provide matrix complying with NTMA's "Guide Specification for Epoxy Terrazzo" in color required for mix indicated.

1. Shore Hardness at 24 Hours: 85/65 at 24 hours, when tested per ASTM D 2240.
2. 100% concrete failure minimum, with 350 psi minimum tensile strength.
3. Compressive Strength: Minimum of 11,000 psi when tested per ASTM D 695.
4. Tensile Strength: Minimum of 6,000 psi when tested per ASTM D 638.
5. Flexural Strength: Minimum of 10,000 psi when tested per ASTM D 790.
6. Flammability: Self-extinguishing over concrete, tested per ASTM D 635.
7. Abrasion Resistance: 70-90 milligrams lost when tested per ASTM D 4060.

E. Thin-Set Divider Strips: Angle or T type, 3/8 inch (9.5 mm) deep, and as follows:

1. Material: White zinc alloy.
2. Top Width: 1/8 inch (3.2 mm).
3. Thickness: 16 gage.

F. Control-Joint/Expansion Joint Strips: T-type strips with neoprene expansion insert matching material, thickness, and color of divider strips in depth required for topping thickness indicated.

1. Top Width: 1/8 inch (3.2 mm).

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G. Accessory Strips: Match divider-strip width, material, and color, unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Edge beads for exposed edges of terrazzo.

H. Patching and Fill Material for Epoxy Terrazzo: Resinous product of or approved by terrazzo manufacturer and recommended by manufacturer for application indicated.

I. Joint Sealants: Recommended by terrazzo and sealant manufacturers and complying with requirements in Division 7 Section "Joint Sealants"

J. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. in 24 hours.

K. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D412.

1. Reinforcement: Fiberglass scrim, as required.

L. Divider-Strip Adhesive: Epoxy-resin adhesive recommended by manufacturer for this use and acceptable to thin-set terrazzo resin manufacturer.

M. Thin-Set Terrazzo Primer: Two-component resin or other compound recommended by thin-set terrazzo resin manufacturer for priming substrate.

N. Thin-Set Terrazzo Finishing Grout: Thin-set terrazzo resin manufacturer's resin-based finishing grout.

O. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

P. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10, does not affect color or physical properties of terrazzo type indicated, is recommended by sealer manufacturer for this use, and complies with NTMA Guide Specification for terrazzo type indicated.

1. Use sealers that have a VOC content of not more than 200 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

2.3 MIXES

A. Epoxy-Resin, Thin-Set Terazzo: Comply with NTMA's "Guide Specification for Epoxy Terrazzo" and resin manufacturer's written instructions for component proportions and mixing.

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1. Colors and Patterns: As selected by Architect.
2. Thickness: 1/4" or 3/8" depending on aggregates used.

2.4 LOGOS

A. Create custom logo using waterjet technique to cut shapes into which terrazzo is poured. Comply with design indicated on the Drawings and artwork provided by the Architect.

2.5 PRECAST EPOXY TERRAZZO

A. Manufacturers: Subject to compliance with requirements, provide products one of the following or equal:

1. Romoco Precast Terrazzo Products
2. Wausau Tile, Inc.; Terra Paving Products Division
3. Concord Terrazzo Company, Inc.; TERRAZZCO

B. Precast Epoxy Terrazzo Base Units: 1/4 inch (6.4 mm) thick; cast in maximum lengths possible, but not less than 36 inches (900 mm); with rounded, finished top edge.

1. Type: As indicated.
2. Height: As indicated
3. Outside Corner Units: With finished returned edges at outside corner.
4. Color and Pattern: Match adjacent terrazzo flooring

C. Precast Terrazzo Stair Tread and Riser Units: Comply with NTMA's written recommendations for fabricating precast cementitious terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.

1. Type: Flat tread with riser, 2-piece
2. Color and Pattern: As selected by Architect.
3. Size: As indicated on Drawings
4. Thickness: 1/2" minimum.
5. Stair Treads and Landings: Three-line abrasive inserts at nosings in color selected by Architect.
   a. Abrasive Strips: Fabricate with surface of abrasive strip positioned 1/16 inch (1.6 mm) higher than terrazzo surface

D. Setting Materials for Precast Terrazzo:

1. Epoxy Adhesive: Two component, compatible with terrazzo units and substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

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A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of terrazzo. Do not proceed with installation until unsatisfactory conditions, including levelness tolerances, have been corrected.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of terrazzo
2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
4. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions

C. Concrete Moisture Emission Tests: Perform calcium chloride test or relative humidity test as per manufacturer's directions, as follows, and other tests if recommended by terrazzo flooring manufacturer:

1. Perform moisture test at rate of one per 2,000 sq.ft. of floor area to be finished.
2. Report test results in writing to Architect, and Contractor within 24 hours after tests are completed. Reports of concrete moisture emission tests shall contain the Project identification name and number, date of test location of test within structure.
3. Perform additional moisture emission tests of in-place concrete when test results indicate specified moisture content has been exceeded, as directed by Architect.
   a. Repeat test one week after initial test minimally and additionally repeat test if required by field conditions to determine moisture levels in area of terrazzo flooring application.

D. Do not proceed with installation until unsatisfactory conditions have been corrected or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.

3.2 PREPARATION

A. Prepare thin-set-terrazzo substrates according to resin manufacturer's written instructions.

1. Clean substrates of substances that impair terrazzo's bond, including oil, grease, and curing compounds.
2. Repair damaged and deteriorated concrete substrates to acceptable condition.
3. Level existing concrete subfloor to required flatness tolerances; not to vary more than 1/4 inch from true plane in a 10 foot span.
4. Roughen concrete substrates before installing terrazzo according to NTMA's and epoxy flooring manufacturer’s written recommendations.
5. Leave surface free of dust, dirt, laitance and efflorescence.

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B. Cracks: Locate cracks and joints in concrete substrates. Verify location of control joints and expansion joints in epoxy terrazzo flooring.

1. After examining existing conditions of substrate, prepare and submit a written report of existing conditions and Installer's proposed plan for installation of crack suppression membrane; include specific recommendations on type and location of crack suppression membrane system to be provided. Obtain Architect's approval of proposed plan before commencing with installation of crack suppression membrane system.

C. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install concrete substrates that fail preinstallation moisture testing.

D. Substrate-Crack-Suppression Membrane: Install crack suppression/isolation membrane in accordance with manufacturer's recommendations and as per Installer's approved plan.

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim as required.

E. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY TERRAZZO INSTALLATION

A. General: Comply with NTMA Guide Specification for terrazzo type indicated and NTMA's written recommendations for substrate preparation and terrazzo installation.

B. Prime thin-set-terrazzo substrates according to resin manufacturer's written instructions.

C. Install divider and accessory strips according to NTMA's written recommendations.

D. Install control-joint strips back-to-back directly above substrate control joints and according to NTMA's written recommendations.

E. Install angle- or T-type strips and similar accessories in adhesive setting bed without voids below strips. Provide mechanical anchorage of strips as required for adequate attachment of strips to substrate.

F. Assemble logo template on substrate by installing waterjet cut shapes, shop-fabricated and shipped to the site, as per approved template and layout shop drawing. Logo surface shall be level with surrounding terrazzo floor surface. Fill shapes with terrazzo to match approved colored rendering shop drawing.

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G. Thin-Set Terrazzo: Place, cure, grind, grout, and finish thin-set terrazzo according to resin manufacturer's written instructions and NTMA Guide Specification for thin-set terrazzo type indicated. Ensure fluids from grinding operations do not react with divider and control-joint strips and stain marble chips. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

H. Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound when tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

I. Construction Tolerances: Limit terrazzo surfaces' variation from level to 1/4 inch in 10 feet (6.4 mm in 3 m).

3.4 PRECAST EPOXY TERRAZZO

A. Set units using method recommended by NTMA and manufacturer unless otherwise indicated. Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width.

1. Use epoxy adhesive to install treads, risers, and wall base according to ANSI 108.6.

B. Seal joints between units with joint sealants.

3.5 CLEANING AND PROTECTING

A. Remove grinding dust from installation and adjacent areas.

B. Cure the thin-set epoxy terrazzo flooring in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.

C. Rinse surfaces with water and allow to dry thoroughly.

D. Seal surfaces according to NTMA's written recommendations. Apply sealer according to sealer manufacturer's written instructions.

E. Protect the thin-set epoxy terrazzo flooring system from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to Substantial Completion.

F. Clean the thin-set epoxy terrazzo flooring system just prior to final inspection, using materials and procedures suitable to the system manufacturer.

END OF SECTION 096623

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SECTION 096723 - RESINOUS FLOORING

1.1 SUMMARY

A. This Section includes the following:

1. Four-component decorative double broadcast epoxy flooring system with integral base

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: Demonstrating manufacturer’s complete line of available colors.

C. Samples for Verification: Minimum 3" x 3" sample of selected color demonstrating color and texture of installed system.

1.3 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: In lieu of material test reports, when permitted by Architect, signed by manufacturers certifying that materials furnished comply with requirements.

C. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for installing resinous flooring systems specified.
2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

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1.5 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.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT 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. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Products: Provide specified materials of DUR-A-FLEX Inc. or equal products of one of the following:

1. Dex-O-Tex.
2. Tennant Company
3. Stonhard

2.2 MATERIALS

A. Resinous Flooring: Resinous floor surfacing system consisting of flexible membrane, decorative broadcast, grout coat and finish coat. Comply with requirements indicated in this Article.

B. Substrate Patching and Fill Material: Cementitious product approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

D. Four Component Epoxy Flooring System with Decorative Broadcast: Quartz flooring system double broadcast into flexible epoxy applied over interior concrete floors, sealed with grout coat, and topcoated with urethane. System shall comply with the following:

1. Basis of Design System: Shop Floor by Dur-A-Flex Inc., or equal.
2. Thickness of System: 1/8 inch.

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3. Membrane Primer: Two-component flexible epoxy primer; Elast-O-Coat or equal, in colors selected by Architect.
4. Broadcast Coat, Grout Coat and First Topcoat: Two-component epoxy Dur-A-Glaze Shop Floor or equal, in colors selected by Architect.
5. Quartz Broadcast Aggregate: Uniformly shaped and sized quartz granules, Flintshot quartz aggregate, in colors selected by Architect.
6. Final Topcoat: Two-component urethane, Armor Top, or equal.
7. Integral Cove Base: 6" high.
8. System Color: As selected by the Architect.
9. System Texture: Standard non-skid

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.

B. Use patching and fill material as required to fill holes and depressions in substrate to provide a flat and even surface for flooring system. Apply patching and fill material according to manufacturer's written instructions.

C. 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. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
2. Verify that concrete substrates are dry. Perform calcium chloride test or relative humidity test as per manufacturer's directions, as follows, and other tests if recommended by resinous flooring manufacturer:
   a. Calcium Chloride Test: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft.of slab in 24 hours.
   b. Relative Humidity Test: Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement
   c. Perform moisture test at rate of three for the first 1,000 sq. ft. and one additional test for each 1,000 sq. ft. of new and existing floor area to be covered unless otherwise recommended by flooring manufacturer.

3. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
4. Verify that substrates and conditions are satisfactory for resin floor installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

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5. If the vapor emission exceeds 75 % relative humidity or 3 lbs/1,000 sf/24 hrs then flooring system manufacturer's moisture mitigation system shall be installed in accordance with manufacturer's directions, prior to resinous flooring installation.
6. Mechanical Preparation of Concrete Floor: Shot blast and abrade the floor surface prior to installation of resinous materials.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Pre-apply epoxy treatment to substrate cracks as required.

C. Apply primer over prepared substrate at manufacturer's recommended rate and allow to cure as recommended by manufacturer.

D. Four Component Epoxy Flooring System with Decorative Broadcast: Apply membrane primer to substrate. Apply first broadcast coat with first aggregate broadcast, allow to cure and sweep off excess aggregate. Apply second broadcast coat with second aggregate broadcast, allow to cure and sweep off excess aggregate, and then vacuum. Apply grout coat, sand floor (if required). Apply first topcoat. Apply urethane final topcoat.

E. System Components:

1. Membrane/Primer: Elast-O-Coat applied at a rate of 80 sf/gal to yield a dry film thickness of 20 mils.
2. First Broadcast: Shop Floor applied at rate of 90-100 sf/gal with Flintshot aggregate broadcast into it at a rate of 0.5 lb./sf.
3. Second Broadcast: Shop Floor applied at rate of 90-100 sf/gal with Flintshot aggregate broadcast into it at a rate of 0.5 lb./sf.
4. Grout Coat: Shop Floor applied at rate of 90-100 sf/gal
5. First Topcoat: Shop Floor applied at rate of 200 sf/gal
6. Final Urethane Topcoat: ArmorTop applied at a rate of 500 sf/gal to yield a dry film thickness of 3 mils.

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F. Integral Cove Base: Apply cove base mix to wall surfaces at locations indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, and topcoating of cove base.

3.3 CLEANING AND PROTECTING

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.

B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

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SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:

1. Division 09 Section "Resilient Flooring and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 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.

1.3 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 installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. 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.

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1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 01. 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.

1.4 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.

1.5 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.

1.6 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).

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Performance Characteristics of Carpet Tile: Provide carpet tile identical to that tested for the following performance characteristics, per test methods indicated:

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1. Flammability: Passes DOC FF 1-70 Pill Test.
2. Flame Spread: Meets NFPA Class 1 when tested under ASTM E-648 Glue Down.
3. Smoke Density: 450 or less, Flaming Mode when tested under NBS Smoke Chamber NFPA-258.
4. Static: No more than 3.5 KV when tested under AATCC-134.
5. Specific Optical Density: Not more than 300 in first 4 minutes tested in flaming or non-flaming mode when tested under ASTM E662.
6. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648 or NFPA 253.

C. Mockups: Before installing carpet tile, install mockups for each type of carpet tile installation required to demonstrate aesthetic effects and qualities of materials and execution. Install mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Install mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be installed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Remove mockups when directed.
7. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion..

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI Carpet Installation Standard 2011.

B. Store carpeting per manufacturer’s recommendations for allowable temperature and humidity range. Products shall not be allowed to become damp.

C. Remove carpeting from packaging and store in unoccupied, ventilated areas (100% outside air supply, minimum of 1.5 air changes per hour, no recirculation) for 24-72 hours prior to installation. Carpeting shall not be stored with materials which have high emissions of VOCs or other contaminants. Materials with high short-term emissions include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paint, wood preservatives, and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; gypsum board (with associated finish processes and products); and composite or engineered wood products with formaldehyde binders

1.9 FIELD CONDITIONS

A. Comply with CRI Carpet Installation Standard 2011 for temperature, humidity, and ventilation limitations.

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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 occupancy levels 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.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: Lifetime.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers: Provide specified Basis of Design products or equal manufactured by one of the following manufacturers:

1. Interface
2. Mannington
3. Milikin
4. Mohawk Commercial Carpet
5. Shaw
6. Tandus Centiva

B. Emissions: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

C. Carpet Tile:

1. Construction: Multi-level Pattern Loop
2. Fibre: Eco Solution Q® Nylon
3. Tufted Weight: 17 oz/yd²
4. Size: 9” x 36”
5. Color: As selected by Architect

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6. Installation: As selected by Architect.
7. Backing: Ecoworx® Tile
8. Warranty: Lifetime Commercial Limited
9. Basis of Design Product: Shaw Contract, Vertical Layers Collection, Style 5T157 “Undertone Tile”

D. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

E. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

F. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

G. Carpet Edge Guard: Refer to Division 09 Section "Resilient Flooring and Accessories."

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. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer. Do not install flooring if subfloor moisture emission rate exceeds indicated amounts.
   a. Calcium Chloride Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed the maximum moisture-vapor-emission rate acceptable to flooring manufacturer.
   b. Moisture Meter Testing: Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have relative humidity level measurement acceptable to flooring material manufacturer.
   c. Testing Procedures
      1) Where flooring is indicated to be applied to structural concrete topping or concrete slab-on-grade substrates, perform moisture meter tests.

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2) Where flooring is indicated to be applied to areas where hydraulic cement topping is installed, perform calcium chloride or moisture meter tests as required by topping manufacturer.

2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI Carpet Installation Standard 2011, Section 7, "Site Conditions; All Installations," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

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 (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. 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 carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed 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 CRI Carpet Installation Standard 2011, Section 18, “Modular Carpet,” and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. 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.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

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F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders, unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI Carpet Installation Standard 2011, Section 20, "Protecting Indoor Installations."

1. Restrict traffic over adhesive installations for a minimum of 48 hours to allow proper adhesive cure.
2. Restrict exposure to water from cleaning or other sources for a minimum of 30 days.
3. If required to protect the finished floor covering from dirt or paint, or if additional work is to be done after the installation, cover carpeting with a non-staining building material paper.
4. Protect the installation from rolling traffic by using sheets of hardboard or plywood in affected areas.

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 096813

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SECTION 097750 - FIBER REINFORCED PLASTIC COATED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fiberglass reinforced polyester (FRP) panels.

1.2 ACTION SUBMITTALS

A. Product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.

B. Samples for initial selection purposes of each type and color available for fiber reinforced plastic coated panels and molding accessory required of size indicated below:

1. 3 inch square sample of each fiber reinforced plastic coated panel specified.
2. 6-inch long sample of each molding accessory.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates signed by fiber reinforced plastic coated panel manufacturer certifying materials furnished comply with specified requirements.

B. Certified test reports showing compliance with requirements for fire performance characteristics and physical properties.

C. Maintenance data for inclusion in Division 01 Section "Closeout Procedures." Include the following:

1. Methods for maintaining fiber reinforced plastic coated panels.
2. Precautions for use of cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide fiber reinforced plastic coated panels with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify fiber reinforced plastic coated panels with appropriate markings of applicable testing and inspecting organization.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

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B. Installer Qualifications: Arrange for installation of fiber reinforced plastic coated panels by a firm that can demonstrate successful experience in installing similar in type and quality to those required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect units during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

1.6 PROJECT CONDITIONS

A. Maintain a constant temperature not less than 70°F in installation areas for at least ten (10) days before and ten (10) days after installation.

B. Field Measurements: Where units are indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide FRP products as manufactured by Kal-Lite Division, Kalwall Corp.; or an approved equivalent by one of the following:

1. Marlite, Division of Commercial and Architectural Products, Inc.
2. Crane Composites, Inc.

2.2 FRP PANELS:

A. FRP Panels: High gloss fiberglass reinforced polyester panels 0.060" thick with smooth surface, Class A fire rating, 4-feet wide by height required.

1. Color(s) As selected by Architect for each location.
2. Basis of Design Product: "Kal-Lite Fiberglass Sheeting LF (Low Flame)" manufactured by Kal-Lite, or approved equivalent

B. Accessories: Provide inside corner, outside corner, division molding and edge trim moldings by same manufacturer, matching wall panels.

C. Adhesive: Manufacturer's standard low odor, VOC compliant, non-flammable latex based adhesive for use and substrate.

D. Sealant: Manufacturer's standard clear silicone sealant meeting local VOC requirements.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of fiber reinforced plastic coated panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Acclimate panels to room temperature for 48 hours prior to installation.

C. Follow manufacturer's printed instructions for surface preparation.

3.3 INSTALLATION

A. Do not use materials that are unsound, warped, bowed or twisted.

B. Install fiber reinforced plastic coated panels plumb, level, true, and aligned with adjacent materials.

1. Scribe and cut panels to fit adjoining work.
2. Install to tolerance of 1/32 inch in 8 feet for plumb and level.
3. Coordinate with materials and systems that may be in or adjacent to panels. Provide cutouts for mechanical and electrical items that penetrate.

C. Plan fiber reinforced plastic coated panel layout, balancing panel sizes at corners.

1. Adhere division molding and work from center of wall to corners.
2. Adhere FRP panels to substrate in accordance with manufacturer's written instructions.
3. Stagger joints between panels and substrate material.
4. Provide moldings at all sides of panels. Adhere ceiling line and curb moldings in place with sealant, and provide sealant in molding channels prior to insertion of panels.
5. Remove excess sealant from panel surfaces immediately.

3.4 ADJUSTING AND CLEANING

A. Repair damaged or defective fiber reinforced plastic coated panels where possible to eliminate functional or visual defects. Where not possible to repair, replace fiber reinforced plastic coated panels.

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B. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

C. Use cleaning methods recommended by the fiber reinforced plastic coated panel manufacturer.

D. Replace panels that cannot be cleaned.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure panels are without damage or deterioration at time of Substantial Completion.

END OF SECTION 097750

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SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior and exterior substrates:

1. Concrete masonry units (CMU).
2. Concrete
3. Steel and iron.
4. Galvanized metal.
5. Gypsum board.
6. Wood
7. Wood products (MDF)
8. Plastic trim fabrications (Cellular PVC “Azek”).
9. Fiberglass reinforced plastic (FRP)
10. Fiber cement

B. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.

1.2 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples 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: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

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1.3 QUALITY ASSURANCE

A. MPI Standards: Maintain copy of this standard at the Project site at all times.

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples 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. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
   b. Stained Concrete Floor: Provide mock-up approximately 5' x 5'; locate where directed by Architect.
   c. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 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.

1.5 PROJECT 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.

C. Do not apply paints in snow, rain, fog, or mist; 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

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2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company.
4. Tnemec
5. Dur-A-Flex

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)and the OTC (Ozone Transport Commission) restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.
7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
17. Fire Retardant Paint: VOC content of not more than 60 g/L.

C. Colors: As scheduled or if not scheduled, as selected by Architect from manufacturer's full range.

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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 work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: Maximum 3 lbs/1000 sq ft of surface when tested per ASTM F710.
2. Masonry: 12 percent.
3. Gypsum Board: 12 percent.
4. Wood: 15 percent

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

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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.

1. For stained floor surfaces, concrete shall have cured minimum of 28 days before beginning staining process. Test floors for water absorption per manufacturer's directions. Perform acid etching or mechanical abrading processes if water does not readily absorb into concrete.

E. Concrete Masonry Substrates: Remove 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.

F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

I. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
2. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
3. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. When transparent finish is required, backprime with spar varnish or polyurethane.

J. Plastic Trim Fabrications Substrates:

1. Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
2. Lightly sand any areas that are shiny using very fine sandpaper (#220 grit) and wipe down.
3. Fill nail and screw holes with acrylic Bondo, or equal.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

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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.

B. Application Procedures: Apply paints and coatings by brush or roller according to the manufacturer's directions, except s noted below. Spray application is not permitted for trim, ceilings and walls, unless specifically approved by Architect in advance for each individual situation. Roller application on woodwork is not permitted.

1. 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.
2. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
3. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

F. 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.

G. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:
   a. Uninsulated metal piping.
   b. Uninsulated plastic piping.
   c. Pipe hangers and supports.
   d. Tanks that do not have factory-applied final finishes.
   e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

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2. Electrical Work:
   a. Switchgear.
   b. Panelboards.
   c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials 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 with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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 EXTERIOR PAINTING SCHEDULE

A. General: Provide listed products or equal products of other named manufacturers in Part 2.

B. Steel and Iron Substrates: Polyurethane, Pigmented, Epoxy Zinc Rich Primer and High-Build Epoxy Coating System: Gloss or Semi-Gloss as selected by the Architect.

1. Prime Coat: Epoxy Zinc Rich Primer. Tnemec: Tneme-Zinc Series 90-97 or equal.

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2. Intermediate Coat: High-performance, polyamide-epoxy coating; High-Build Epoxy Marine Coating, Low Gloss: Tnemec: Hi-Build Epoxoline, Series 66, tinted slightly lighter than top coat., or equal
3. Topcoat (Gloss): Aliphatic Acrylic Polyurethane, Two-Component, Pigmented, Gloss: Tnemec Endura-Shield II Series 1074.
4. Topcoat (Semi-Gloss)t: Aliphatic Acrylic Polyurethane, Two-Component, Pigmented, Semi-Gloss: Tnemec Endura-Shield II Series 1075.

C. Zinc-Coated (Galvanized) Metal: Full-gloss, acrylic latex enamel finish - 2 coats - self-priming.

1. Prime Coat: Gloss acrylic latex enamel paint; MPI # 114, X-Green 114, 154, X-Green 154, 164, LEED 2009, LEED V4.
   a. Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28

2. Top Coat: Gloss acrylic latex enamel paint; MPI # 114, X-Green 114, 154, X-Green 154, 164, LEED 2009, LEED V4.
   a. Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28

D. Fiber Cement Siding and Trim: Waterborne Acrylic-Latex System; 2 finish coats over a primer. provide in semi-gloss, satin or flat finish as selected by Architect.

1. Prime Coat: Acrylic Primer; MPI # 6, 17, X-Green 17, 39, 50, X-Green 50, 137, X-Green 137, LEED Credit, CHPS Certified.
   a. Benjamin Moore Fresh Start High-Hiding All Purpose Primer 046

2. Intermediate Coat and Topcoat: One of the following, as selected by Architect:
   a. Semi-Gloss Finish: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29 (147 g/L), MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009, LEED V4
   b. Satin Finish: Benjamin Moore Ultra Spec EXT Satin N448 (46 g/L), MPI # 15.
   c. Flat Finish: Benjamin Moore Ultra Spec Exterior Flat Finish N447 (45 g/L), MPI # 10.

E. Plastic Fabrications Substrates (Azek) and Fiberglass (FRP): Semigloss Waterborne Acrylic-Latex System; 2 finish coats over a primer.

1. Prime Coat: Factory-formulated acrylic-latex primer for exterior application.
   a. Benjamin Moore; Insl-X Stix Waterborne Bonding Primer SXA-110

2. Intermediate Coat and Topcoat: Factory-formulated semigloss waterborne acrylic-latex for exterior application; MPI # 11
   a. Benjamin Moore; Ben Waterborne Exterior Soft-Gloss 543

NOTE: Use the above system for colors that have a LRV (light reflective value) of 55 or higher (lighter colors). If colors selected has an LRV of 54 or lower (darker colors), use paints with heat reflective characteristics specifically formulated for use on vinyl/PVC products (vinyl-safe); one prime and two top coats.

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3.7 INTERIOR PAINTING SCHEDULE

A. General: Provide listed products or equal products of other named manufacturers in Part 2.

B. Gypsum Board Ceilings: Flat acrylic finish.

1. Prime Coat: Latex-based, interior primer; MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534

2. Intermediate Coat and Topcoat: Factory-formulated flat acrylic latex paint for interior application; MPI # 53, X-Green 53, 143, X-Green 143, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Interior Latex Flat N536

C. Gypsum Drywall Walls: Low-luster (eggshell), acrylic finish.

1. Prime Coat: Latex-based, interior primer; MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534

2. Intermediate Coat and Topcoat: Low-luster (eggshell or satin), acrylic-latex, interior enamel; MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139, LEED 2009 LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Latex Eggshell N538.

D. Gypsum Drywall Walls at Wet Areas (where scheduled): Decorative epoxy wall system; two-component, low odor, 100% thermosetting formulation of DUR-A-GARD (pigmented) epoxy, DUR-A-GLAZE # 4 (clear) epoxy and Dur-A-Flex decorative chip that is designed especially for wall applications.

1. Color: As selected by Architect from MICRO and MACRO Chip Color Blends, from standard or custom colors and blends.
2. Topcoats: Two coats of a high gloss or satin finish urethane topcoat, as selected by Architect.
3. Basis of Design Product: Dur-A-Wall VC by Dur-A-Flex, or equal.

E. Hollow Metal Doors, Frames, and Sidelights, and Ferrous Metals: Semigloss, acrylic-enamel finish.

1. Prime Coat: Rust-Inhibitive Primer (Water Based), MPI #107, X-Green 107, 134, LEED 2009, CHPS Certified.
   a. Benjamin Moore; Super Spec HP Acrylic Metal Primer P04.

2. Intermediate Coat and Topcoat: Factory-formulated semigloss acrylic-latex enamel for interior application; MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009, LEED V4.
   a. Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29

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F. Concrete Masonry Units (CMU): Alkyd, water-based finish; in sheen as selected by Architect.

1. Prime Coat/Block Filler: MPI # 4, X-Green 4, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore Super Spec Masonry Interior/Exterior Hi-Build Block Filler 206.

2. Intermediate Coat and Topcoat: Alkyd, water-based finish; LEED 2009, LEED V4, CHPS Certified. One of the following:
   a. Satin: Benjamin Moore Advance Waterborne Interior Alkyd Satin 792.
   b. Semi-Gloss: Benjamin Moore Advance Waterborne Interior Alkyd Semi-Gloss 793.
   c. High Gloss: Benjamin Moore Advance Waterborne Interior Alkyd Gloss 794.

G. Concrete Masonry Units (CMU) at Wet Areas (where scheduled):Decorative epoxy wall system; two-component, low odor, 100% thermosetting formulation of DUR-A-GARD (pigmented) epoxy, DUR-A-GLAZE # 4 (clear) epoxy and Dur-A-Flex decorative chip that is designed especially for wall applications.

1. Color: As selected by Architect from MICRO and MACRO Chip Color Blends, from standard or custom colors and blends.
2. Topcoats: Two coats of a high gloss or satin finish urethane topcoat, as selected by Architect.
3. Basis of Design Product: Dur-A-Wall VC by Dur-A-Flex, or equal.

H. Painted Woodwork and Wood Products (MDF): Semigloss, acrylic finish.

1. Prime Coat: Latex-based, interior primer; MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534

2. Intermediate Coat and Topcoat: Semigloss acrylic-latex, interior enamel; MPI # 43, X-Green 43, 146, X-Green 146, 140, X-Green 140, LEED 2009, LEED V4, CHPS Certified.
   a. Benjamin Moore; Ultra Spec 500 Latex Semigloss N539.

END OF SECTION 099100

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SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Panel signs.
2. Signage accessories

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, and braille layout.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

1. Panel Signs: Samples of each finish type and color, on not less than 4-inch squares of plastic material, showing the full range of colors available

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Approved samples will be returned for installation into Project.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by signage manufacturer.

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B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with ANSI A.117.1 - 2017 and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
   a. Room Capacity.
   b. Elevator Signs.
   c. Stairway Identification.
   d. Signs for Accessible Spaces.

2. Special Signage for Truss Construction: Provide truss identification sign in compliance with 19 NYCRR Part 1264, minimum 6" diameter; for locations as directed by Architect.

1.5 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Manufacturers of Panel Signs:
   a. ASE (Architectural Signs and Engraving) Manufacturing.
   b. Mohawk Sign Systems.
   c. Tactile Signage Inc.

2.2 PANEL SIGNS

A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.
2. Sign materials shall meet a Class A finish.

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B. Interior Panel Signs: Sand carved 1/8 inch (3.1 mm) thick melamine plastic. Provide lettering, graphics and background materials in colors as indicated on Drawings, as approved by Architect.

1. Produce smooth, even, level sign surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.58 mm) measured diagonally.
2. Lettering and Braille Content: Provide uppercase letters raised 1/32 inch (.79 mm), and grade 2 braille for each specific location. Minimum text height: 5/8 inch (15.8 mm).
3. Pictograms: Provide graphics raised 1/32 inch (.79 mm), with minimum 6 inch (152.4 mm) high background field, and lettering and braille written description directly below.
4. Lettering Style: Gill Sans upper case.
5. Copy Location: Centered.
6. Corners and Edges: Radius corners and square edges.
7. Product: One of the following:
   a. “Blast Etched Melamine Series 100" by ASE (Architectural Signs and Engraving) Manufacturing.
   b. Series 200A, Sand Carved by Mohawk Sign Systems.
   c. Melamine Graphic Blast by Tactile Signage Inc

8. Provide specified signage as scheduled.

C. Exterior Panel Signs (Truss Identification Signs):

1. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing); 0.080 inch (2.03 mm) thick.
   a. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five (5) years for application intended.

2. Edge Condition: Square cut.
3. Corner Condition: Square.
4. Mounting: Unframed.
   a. Wall and door mounted.
   b. Manufacturer’s standard noncorroding anchors for substrates encountered.
   c. Custom Paint Colors: Circle and contents shall be reflective red, conforming to Pantone system (PMS) #187.
   d. Background Color: Reflective white.

5. Signs identifying the existence of truss construction shall consist of a circle 6-inches (152.4 mm) in diameter, with a stroke width of 1/2-inch (13 mm).
6. Signs identifying the existence of truss construction shall contain the roman alphanumeric designation of the construction type of the building, in accordance with the provisions for the classification of types of construction set forth in Section 602 of the Building Code of New York State (refer 19 NYCRR Part 1221), and an

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alphabetic designation for the structural components that are of truss constriction, as follows:
a. “F” shall mean floor framing, including girders and beams.
b. “R” shall mean roof framing.
c. “FR” shall mean floor and roof framing.

7. The construction type designation shall be placed at the twelve o’clock position over the structural component designation, which shall be placed at the six o’clock position.
8. Signs identifying the existence of truss construction shall be affixed in the locations identified below:
   a. On exterior building entrance doors, exterior exit discharge doors, exterior roof access doors to stairway; sign shall be attached to the doors, or attached to a sidelight or the face of the building not more than 12-inches (305 mm) horizontally from the latch side of the door jamb, and not less than 42-inches (1067 mm) nor more than 60-inches (1524 mm) above the adjoining walking surface.
   b. At multiple contiguous exterior building entrance or exit discharge doors, signs shall be attached at each end of the row of doors and at a maximum horizontal distance of 12-feet (3.65 m) between signs, and not less than 42-inches (1067 mm) nor more than 60-inches (1524 mm) above the adjoining walking surface.
   c. At fire department hose connections, signs shall be attached to the face of the building not more than 12 inches (305mm) horizontally from the center line of the fire department hose connection, and not less than 42-inches (1067 mm) nor more than 60-inches (1524 mm) above the adjoining walking surface.

9. Text and Layout: Refer to attached exhibit at the end of this Section.

2.3 PANEL ACCESSORIES

A. Mounting Methods: Use stainless steel exposed fasteners or double sided tape by 3M.

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 work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

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D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate interior wall signs and accessories where indicated, in accordance with ANSI A.117.1 - 2017 and with code provisions as adopted by authorities having jurisdiction, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Mount signs on wall adjacent to the latch side of door, unless otherwise indicated. Where there is no wall space to the latch side of the door, including at double leaf doors, mount sign on the nearest adjacent wall as approved by the Architect. Mount signs at 48-inches (1219 mm) from the baseline of the lowest characters to the finished floor.
3. Locate signs to allow approach within 3-inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach signs to wall surfaces using methods indicated below:

1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
2. Double Sided Tape: Apply to back of sign, peel off protective covering and press firmly to wall in desired location.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 INTERIOR SIGN SCHEDULE

A. Provide signage at entrance to each room as described below.

ROOM	**SIGN CONTENT**		**QUANTITY**
	TEXT AND SIZE	**SYMBOLS**	
Accessible Toilet Rooms	T 3/4" (19 mm).	SA, P	at each toilet room
All Assembly Spaces	MAXIMUM OCCUPANCY ___ _____persons 2 " (see Note 1 below)		one at each room

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ROOM	SIGN CONTENT		QUANTITY
	TEXT AND SIZE	SYMBOLS	
Elevator Landings	" IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS ", ½" high		at each elevator landing
Stairs	text indicating floor level		at each stair main landing
Any other locations as required by Code	to be supplied by Architect		1 each location required

B. **Sign Content Key***

T Text describing room, as approved by Architect.
SA International Symbol of Accessibility
P Pictogram (boys, girls, men, women)

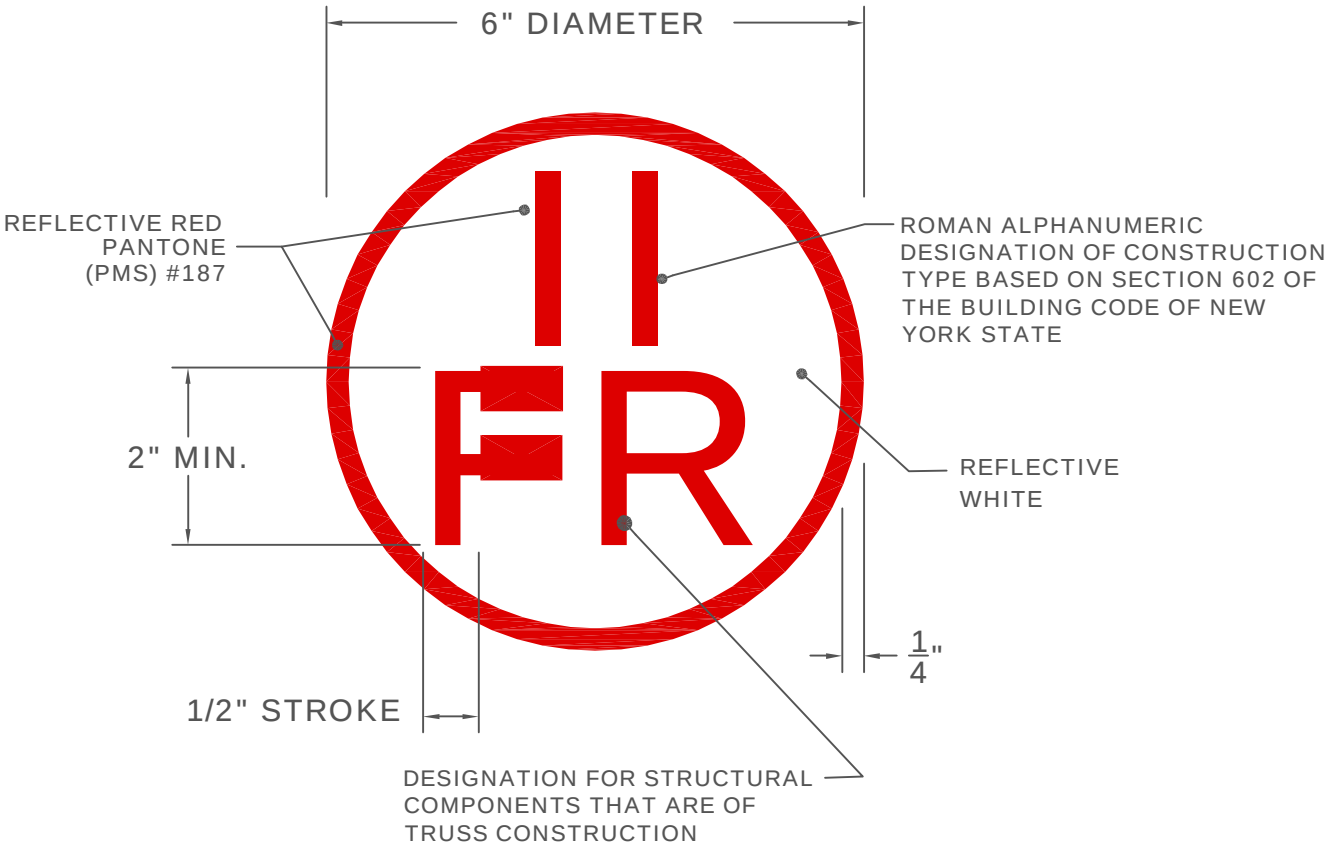
Note 1: Coordinate with Architect for occupancy capacity numbers to include on signage

3.5 EXTERIOR PANEL SIGN SCHEDULE

A. Provide signage at locations as described below.

SIGN	SIGN CONTENT		QUANTITY
	TEXT AND SIZE	SYMBOLS	
Truss Identification Signs as required by Code	Refer to Attachment and information in Paragraph 2.2 of this Section	none	1 each location required- refer to information in Paragraph 2.2.2 of this Section

END OF SECTION 101400



"F"	FLOOR FRAMING, INCLUDING GIRDERS AND BEAMS
"R"	ROOF FRAMING
"FR"	FLOOR AND ROOF FRAMING

TRUSS IDENTIFICATION SIGN
COMPLIANCE WITH 19 NYCRR PART 1264

NOT TO SCALE

CODES DIVISION

DEPARTMENT OF STATE

EXAMPLE TRUSS IDENTIFICATION SIGN DATE:03/08/2005

NEW YORK STATE DEPARTMENT OF STATE
DIVISION OF CODE ENFORCEMENT
AND ADMINISTRATION

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SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid phenolic units as follows:

1. Toilet Enclosures: Floor-mounted, overhead braced.
2. Urinal Screens: Wall hung

B. Related Requirements:

1. Section 102800 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product data for each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch- (150-mm-) square samples of same thickness and material indicated for Work

1.3 INFORMATIONAL SUBMITTALS

A. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.

1.4 QUALITY ASSURANCE

A. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet compartments and related items. Coordinate delivery with other work to avoid delay.

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B. Fire-Test-Response Characteristics: Provide materials with surface-burning characteristics as indicated below, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 75 or less.
2. Smoke Developed: 450 or less

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.6 WARRANTY

A. Warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Provide a manufacturer's warranty covering the material and workmanship for a period of twenty-five (25) years from the date of final acceptance.

C. Repair or replace any part which becomes defective or breaks during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide specified products of Bobrick or equal products of one of the following:

1. Bradley Corp., Mills Partitions
2. ASI Global Steel Products Corp
3. General Partitions Manufacturing Corp.
4. Metpar Steel Products Corp.

2.2 MATERIALS

A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

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B. Solid Phenolic Panels: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges.

1. Thickness: 1/2 inch, except doors and stiles shall be 3/4" thick.
2. Color and Pattern of Face Sheets: As selected by Architect.
3. Color of Exposed Phenolic Core at Panel Edges: Black
4. Finish: Matte.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

D. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories, complying with ADA requirements, of the following material:

1. Material: Stainless steel.

F. Mounting Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

1. Material: Stainless steel.

G. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

1. Basis of Design Product: DuraLine Compact Laminate (Solid Phenolic) 1080 Series by Bobrick or equal.

B. Overhead-Braced Compartments: Provide galvanized steel angle supports and leveling bolts at pilasters as recommended by manufacturer to suit floor conditions. Make provisions for setting and securing continuous, extruded, aluminum, antigrip, overhead bracing at top of each pilaster. Provide shoe at each pilaster to conceal supports and leveling mechanism.

C. Screens: Attach with anchoring devices as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

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D. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Continuous spring-loaded type fabricated from extruded aluminum with nylon separators at knuckles and stainless pivot pins, that can be adjusted to hold door open at any angle up to 90 degrees. Provide theft proof fasteners concealed under a snap-on cover.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with brackets attached to the panel. Locate wall bracket fasteners so holes for wall anchors occur in masonry or tile joints. Secure panels in position with manufacturer's recommended anchoring devices.

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B. Overhead-Braced Compartments: Secure pilasters to floor and level, plumb, and tighten installation with devices furnished. Secure overhead brace to each pilaster with not less than two fasteners. Hang doors and adjust so that tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.3 ADJUST AND CLEAN

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 102113

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SECTION 102800 - TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Washroom accessories.
2. Shower accessories.
3. Mirrors.
4. Warm air hand dryers.
5. Baby changing station.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Contract Drawings.
2. Identify products using designations indicated on Contract Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals, including replaceable parts and service recommendations.

1.3 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Inserts and Anchorages: Furnish accessory manufacturer’s standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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1.4 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.

1.5 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: The design for toilet accessories is based on certain named equipment. Subject to compliance with requirements, provide the named product or an equivalent product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Dryer, Inc.
3. American Specialties, Inc.
4. Bradley Corporation.
5. Bobrick Washroom Equipment
6. Excel Dryer Corporation.
7. World Dryer Corporation

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) (22-gage) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) (20-gage) minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

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F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 PRODUCTS

A. Washroom Accessories: Provide Basis of Design Products scheduled on Drawings, or equal.

B. Shower Accessories: Provide Basis of Design Products scheduled on Drawings, or equal

C. Mirrors. Provide Basis of Design Products scheduled on Drawings, or equal

D. Warm Air Hand Dryers: Provide Basis of Design Products scheduled on Drawings, or equal

E. Baby Changing Station: Provide Basis of Design Products scheduled on Drawings, or equal

2.4 FABRICATION

A. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating manufacturer’s name and product number

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation.

E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

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3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer’s written instructions for type of substrate involved.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446, and in compliance with ADA Regulations.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for unencumbered, smooth operation. Verify that mechanisms function smoothly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations after removing temporary labels and protective coatings.

END OF SECTION 102800

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SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wardrobe lockers, double tier, knocked-down type, including ADA compliant lockers.
2. Turnout gear lockers, wall mounted and freestanding.
3. Locker room bench, ADA compliant.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Show locker fillers, trim, base, and accessories.
2. Include locker-numbering sequence of lockers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.

1. Lockers.

E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 01.

F. Qualification Data: For qualified Installer.

1.3 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 type of locker units, benches and accessories through one source for each product.

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C. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Protect lockers from damage during delivery, handling, storage, and installation..

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturer, Wardrobe Lockers: Provide Basis of Design lockers and benches by Penco or equal lockers by one of the following:

1. DeBourgh Manufacturing Co.
2. List Industries, Inc.

B. Available Manufacturer, Turnout Gear Lockers: Provide Basis of Design lockers from GEARGRID Corp. or equal lockers by the following:

1. Groves, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 366/A 366M, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

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B. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, commercial quality, coating Class C; mill phosphatized; suitable for exposed applications; and stretcher leveled or roller leveled to stretcher-leveled flatness.

C. Steel Tube: ASTM A 500, cold rolled

D. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

E. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 WARDROBE LOCKERS

A. Basis of Design Products: Provide Vanguard Locker Series by Penco or equal.

B. Fabrication shall be on the unit principle, each locker with individual door and frame, individual top, bottom, back, and shelves, with common intermediate divisions separating compartments

C. Body: Locker body components shall be made of cold rolled steel specially formed for added strength and rigidity and to ensure tight joints at fastening points. Tops, bottoms, backs, sides, and shelves shall be fabricated from 24 gauge sheet steel. Locker doors measuring less than 12 inches wide shall be fabricated from 18 gauge steel. All other door sizes shall be fabricated from 16 gauge sheet.

D. Frames: Fabricate from channel shape, not less than 16 gauge steel. Provide vertical door frame members with additional 3/8 inch (9.5 mm) flange as a continuous door strike.

E. Doors: Fabricate doors from one piece sheet steel with full channel formation of adequate depth to fully conceal lock bar on lock side, channel formation on hinge side, right angle formations across top and bottom, with holes for attaching number plates. Doors over 15 inches wide by 60 inches or 72 inches high shall include a 3 inch wide 20 gauge full height reinforcing pan welded to inside face of door at 6 inch centers.

1. Provide louvered doors in manufacturer's standard louver pattern.

F. Hinges: Provide two inch high, double spun, full loop, tight pin hinges, projection welded to door frame and securely fastened to the door with steel rivets. Provide three 2 inch fiveknuckle hinges on doors over 48 inches high and two 2 inch high five-knuckle hinges on all other doors.

G. Die-Cast Handle: Provide chrome-plated zinc alloy die-cast case and handle attached to latch bar concealed inside door and tamperproof. Pulling handle out shall move latch bar up and open door in one motion and provide for use of 9/32 inch diameter padlock,

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integral with handle and located so that extension of handle forms padlock strike. Doors over 48 inches high shall use glass-filled nylon clips to engage the door frame and hold the door shut at three points. All other doors engage at two points.

H. ADA compliant lockers shall have recessed handles with multi-point latch.

I. Sizes:12" w x 18"d x 72"h.

J. Configuration: Double tier.

K. Locker Accessories:

1. Interior Equipment: Furnish each locker with the following items, unless otherwise indicated:

   a. Hooks: Manufacturer's standard zinc-plated, ball-pointed steel. Provide one double-prong ceiling hook, and not fewer than two single-prong wall hooks for single-, double-, and triple-tier units. Attach hooks with at least two fasteners.
   b. Rod: Provide manufacturer’s standard rod at ceiling.

2. Number Plates: Manufacturer's standard etched, embossed, or stamped, aluminum number plates with numerals at least 3/8 inch (9 mm) high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
3. Filler Panels: Manufacturer's standard; fabricated from minimum 0.0478-inch-(1.20-mm-) thick steel sheet in an unequal leg angle shape, and finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
4. Finished End Panels: Finished to match lockers, and designed for concealing exposed ends of nonrecessed lockers.
5. Zee Bases: 4" high, manufacturer’s standard construction.

2.4 TURN OUT GEAR LOCKERS

A. Basis of Design Product: GEARGRID Wall Mounted Storage System and Freestanding Units by GearGrid Corporation, or equal.

B. Fabrication: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

C. Vertical Dividers:

1. Outer Frames: 1.25” O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
2. Inner Grid: .25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.
3. Inner Grid wires shall be full length and width of inside vertical divider frame and shall run horizontally and vertically creating a square or rectangular grid pattern.

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4. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

D. Back Panels:

1. Grid: .25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.
2. Back panel grid shall be sandwiched between vertical dividers and shall be secured to vertical dividers via horizontal wires which extend into mounting holes pre-drilled in vertical dividers.
3. Inner Grid wires shall be full length and width of inside vertical divider frame and shall run horizontally and vertically creating a square or rectangular grid pattern.
4. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

E. Shelves: Provide one (1) upper and one (1) lower shelf, fabricated from 0.25” diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Upper shelf shall include an integrated 20 gauge steel bracket to accept a 2” x 16” name placard, unless doors are selected as an option, in which case the name placard shall be integrated into the door.

F. Apparel Hooks: Provide three (3) hooks per locker opening, fabricated from 0.192” diameter ASTM 510 cold drawn steel wire resistance welded, cold formed and powder coated. Apparel hooks shall securely engage and snap onto side or back grid, to prevent unintentional disengagement of hook.

G. Base Assembly for Freestanding Units: Base frame shall be manufactured from 1.25” x 11 gauge wall thickness ASTM A513 square steel tubing. Each unit shall be supplied with bolt down floor support.

H. Accessories:

1. Hang Bar: Provide units manufactured to allow each locker user to install at their desired height. Fabricate from 1.25” O.D. x 16 gauge 304 stainless steel tubing with powder coated brackets that attach to each vertical divider.
2. Heavy Hanger: Fabricate from 0.25” diameter 304 stainless steel wire cold formed and resistance welded with black vinyl coating on hook end.
3. Power Bar: Include 16 gauge steel chase integrated into the upper framework of the locker assembly allowing provision for the installation of a 120VAC duplex outlet (provided by others) at each locker location. Powder coated finish in color to match lockers.

I. Sizes:

1. Wall-Mounted Units: 20"w x 20"d x 74.5"h
2. Freestanding Units: GEARGRID 6-pack unit having three openings each side back-to-back, in 20” unit overall dimensions: 85” high x 63” wide x 39” deep

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J. Finish: Manufacturer's standard powder coated finish in Red.

2.5 ADA LOCKER BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 20-inch- (508-mm-) wide by 1-1/4 inches thick.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Pedestals: Provide pedestal supports, with predrilled fastener holes, complete with fasteners and anchors, and as follows:

1. Type: Tubular, minimum 1-1/2-inch (38-mm) diameter, single piece heavy-duty cast iron or steel pedestal support or cast iron base not more than 6'-0" o.c., with provisions for fastening to floor and securing to bench. Provide all anchorages.
2. Furnish a minimum of four pedestals for each bench, with pedestal spacing not more than 72 inches (1820 mm) o.c..
3. Pedestal color as selected by Architect.

2.6 LOCKS

A. Fabricate lockers to receive the following locking devices:

1. Padlocks; to be supplied by Owner.

2.7 FABRICATION

A. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

2.8 FINISHES, GENERAL

A. Finish all steel surfaces and accessories, except prefinished stainless-steel and chrome-plated surfaces.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STEEL SHEET FINISHES FOR WARDROBE LOCKERS

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.4 mils (0.036 mm) on doors, frames, and legs, and 1.1 mils (0.028 mm) elsewhere.

1. Color and Gloss: As selected by Architect for each location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate for suitable conditions where metal lockers are to be installed.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

C. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

D. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed lockers.

E. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed lockers.

F. Fixed Locker Benches: Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

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3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

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SECTION 105200 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for portable fire extinguishers.
3. Fire-protection accessories.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. NYS Fire Code Compliance: Fabricate and label fire extinguishers to comply with New York State Fire Code.

D. Fire Extinguishers: FM listed and labeled for type, rating, and classification specified.

E. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. J.L. Industries, Inc.
2. Kidde: Walter Kidde, The Fire Extinguisher Co.

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3. Larsen's Manufacturing Company.
4. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

1. Available Product: MP 10, Larsen’s Manufacturing Company.

2.4 FIRE-PROTECTION CABINETS

A. Basis-of-Design Product: Occult Series Model SS 2409, as manufactured by Larsen’s Manufacturing Co., or an approved equivalent product by one of the following:

1. JL Industries, Inc.
2. Kidde Fyrnetics.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
   a. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch (1.2 mm) thick, cold-rolled steel sheet lined with minimum 5/8 inch (16 mm) thick, fire-barrier material.
   b. Provide factory-drilled mounting holes.

2. Cabinet Size: Suitable for specified fire extinguisher.
3. Cabinet Style: Trimless, with concealed hinge and closed door completely covering cabinet flange.
4. Cabinet Material: Enameled-steel sheet.
5. Recessed Cabinet: Cabinet box fully recessed in walls of depth indicated; with box flange overlapping surrounding wall surface and fully concealed by door when in closed position.

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C. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Door Material: Stainless steel sheet
2. Door Style: Flush, solid panel.
3. Door Hardware: Ensure hardware meets ADA requirements. Provide manufacturer's built-in cylinder lock system (*Larsen-Loc*™), or approved equivalent, and door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.
4. Lettering: Provide factory applied lettering that reads “IN CASE OF FIRE ONLY - PULL FIRMLY ON HANDLE.”

2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish. Provide brackets for extinguishers not located in cabinets.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
1. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
   a. Location: Applied to cabinet door.
   b. Application Process: Die cut.
   c. Lettering Color and Style: As selected by Architect.

2. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

D. Steel Finishes: Manufacturer’s standard baked-enamel paint in color selected by Architect for the interior of cabinet.

E. Stainless Steel, No. 4 finish for door and frame.

PART 3 - EXECUTION

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3.1 EXAMINATION

A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure, square and plumb.
3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 105200

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SECTION 105213 - AUTOMATED EXTERNAL DEFIBRILLATOR (AED) SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cabinets for AED unit.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED specialties.

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain AED cabinets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.2 AED CABINETS

A. Basis-of-Design Product: 1400 Series AED Cabinet as manufactured by JL Industries, Inc. or an approved equivalent product by one of the following:

1. Allied Medical Products
2. Phillips Healthcare.
3. Physio-Control
4. ZOLL Medical.

B. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Cabinet Size: Suitable for any size AED unit.
2. Cabinet Style: Exposed one-piece trim and door frame.
3. Cabinet Material: Enameled-steel sheet.

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4. Semi-Recessed Cabinet: Semi-recessed cabinet partially concealed in walls, with 2-1/2" or 3" rolled edge trim overlapping wall surface.

C. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Door Material: Enameled-steel sheet.
2. Door Style: Full acrylic or tempered glass glazing with pull handle and AED graphics on door.

D. Accessories: Provide the following:

1. Audible alarm 85dba, powered by 9 volt battery. Provide with on/off switch
2. Strobe light, powered by 9 volt battery, built-in to cabinet or mounted above cabinet as required by field conditions.

2.3 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

D. Steel Finishes: Manufacturer’s standard baked-enamel paint in color selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing AED specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten cabinets to structure, square and plumb.

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3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 105213

SECTION 107500 FLAGPOLE

PART 1- GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes, but is not limited to the following:

1. Ground set flagpoles.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 033000, CAST-IN-PLACE CONCRETE

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

B 241 Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

2. The National Association of Architectural Metal Manufacturers (NAAMM):
Manual Metal Flagpole Manual

3. National Fire Protection Association (NFPA):

78 Lightning Protection Code

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, installation instructions, use limitations and recommendations for each type of flagpole specified. Provide certifications stating that products comply with specified requirements.

B. Shop Drawings: Provide shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others.

C. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide pole butt samples having minimum length of six inches.

1.7 QUALITY ASSURANCE

A. Source: Provide flagpole and all accessory products and materials which are the products of one manufacturer.

B. Provide each flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.

C. Engineering Certification: Provide manufacturer's certification that flagpoles which have been installed in compliance with their printed instructions and details will withstand 90 mph winds when flying an appropriate size flag as described in NAAMM Manual.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Pole shall be heavily spiral wrapped with waterproof polyethylene, wood stripped, and steel banded for protection during transit.

PART 2-PRODUCTS

2.1 FLAGPOLE

A. Flagpole shall be supplied by Pole Tech Co., Inc. 67 Gnarled Hollow Road, East Setaucket NY 11733, (631)-689 5525 or approved equal.

B. Flagpole shall be seamless 6063-T6 aluminum alloy Catalog Number PT357C and temper; 35 ft. exposed height.

C. Flagpole dimensions shall be as follows:

Exposed height = 35 ft.
Overall height: = 38 ½ ft.
Brush
Finish: Satin

D. Flagpole shall have the following accessories:

1. Top finial ball spun gold anodized.
2. Revolving internal halyard truck assembly
3. Nylon halyard
4. Bronze swivel snaps with neoprene covers
5. Beaded sling with vinyl coated counterweight
6. Flush access door with cylinder lock (no bolt on door frames)
7. New Internal jamb cleat
8. Spun aluminum flash collar
9. Corrugated foundation sleeve

E. All concrete for flagpole foundation shall be 4000 psi, provide shop drawings for review and approval.

PART 3-EXECUTION

3.1 INSTALLATION

A. Flagpole to be installed as per manufacturer's installation specifications rigidly.

B. Flagpole shall be installed by an experienced flagpole erection crew in accordance with the Drawings and approved shop drawings. Foundation tube shall be accurately set, grounded, and filled with concrete. Concrete shall be cured at least 14 days before erection of pole.

C. Pole shall be centered plumb and true in the foundation tube with temporary wood wedges. Space between pole and foundation tube shall be filled with screened dry sand and thoroughly tamped at 6 in. intervals. The tamped sand shall be thoroughly moisture sealed with a 2 in. depth of approved sealant. Following approval of installation, base collar shall be lowered into place and set.

D. Finished surfaces and accessories shall be suitably protected from damage.

E. Grounding and lightning protection shall be in accordance with NFPA 70 and 78.

END OF SECTION 107500

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SECTION 123219 – MANUFACTURED METAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel casework and cabinets.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring casework.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal casework. Include plans, elevations, sections, and attachment details.

1. Indicate types and sizes of cabinets.
2. Indicate locations of hardware.
3. Indicate locations of blocking and reinforcements required for installing casework.

1.3 QUALITY ASSURANCE

A. Accessibility Requirements: For casework indicated as ADA compliant, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA Accessibility Guidelines.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.5 FIELD CONDITIONS

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

B. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Provide Basis of Design Products by Steel Kitchen or equal products of one of the following:

1. Stainless Supply, a JW Metals Products company.
2. SFI; Stainless Fabricators, Inc.

2.2 METAL CABINET MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

B. Nominal Metal Thickness: 20 gauge minimum.

2.3 METAL CABINETS

A. Basis of Design Products: Provide Indoor Line, ADA Compliant Stainless Steel Cabinets by Steel Kitchen, or equal.

B. Product Designations: Drawings indicate sizes and configurations of metal casework.

C. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.

D. Doors: Outer and inner pans that nest into box formation. Fill doors with noncombustible, sound-deadening material.

E. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.

F. Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

1. Lower Cabinets: Removable shelves, not adjustable.
2. Upper Cabinets: Removable and adjustable.

G. Toe Space: Fully enclosed with stainless toe kick on metal clips, 4 inches high, with no open gaps or pockets.

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H. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services.

2.4 METAL CABINET FINISH

A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Stainless Steel Finish: Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

2.5 HARDWARE

A. General: Provide metal casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, Salice 200 series soft-close concealed adjustable hinges, opens 100 degrees with caps.

C. Hinged Door and Drawer Pulls: Stainless-steel, back-mounted pulls, 7” long; Hafele 117.05.610 or equal.

D. Drawer Slides: Stainless steel 20” full extension slides, soft close, rated at 100 lbs capacity; Accuride EC3832 or equal.

E. Adjustable Feet: Stainless steel, rated at 330 lbs capacity per foot.

F. Hanging Rails: Stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION OF CABINETS

A. Install level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
2. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).

B. Base Cabinets: Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches (400 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

C. Adjust casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123219

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SECTION 123616 – STAINLESS STEEL COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stainless-steel countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal countertops only after finishes have been completed in installation areas.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction to receive metal countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

B. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 079200 "Joint Sealants."

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone .
2. Color: Clear .
3. Sealant shall have a VOC content of 250 g/L or less.

2.2 STAINLESS-STEEL COUNTERTOPS

A. Countertops: Fabricate from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch (25 mm) over the base frame or cabinet.

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1. Joints: Fabricate countertops without field-made joints .
2. Weld shop-made joints.
3. Sound deaden the undersurface with heavy-build mastic coating.
4. Extend the top down to provide a 1-inch-thick edge with a 1/2-inch return flange.
5. Form the backsplash coved to and integral with top surface, with a 1/2-inch-thick top edge and 1/2-inch return flange.
6. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.
7. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit.

2.3 COUNTERTOP ACCESSORIES

A. Brackets: Provide heavy-duty stainless steel countertop brackets fabricated from ¼” thick stainless steel plate, 2” wide, with brushed finish, and curved gusset brace. Maximum load capacity shall be 700 lbs. per shelf bracket. Provide in size(s) as required to support each countertop.

1. Basis of Design Product: Steel Design Solutions Delta HD Countertop Support Bracket, or equal.

2.4 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

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 metal countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Securely fasten support brackets to wall at locations where blocking and supports have been installed to receive brackets.

B. Install metal countertops level, plumb, and true; fasten securely to brackets.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

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D. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123616

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SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Recess-mounted linked-tread-type floor mats and frames.

1.2 ACTION SUBMITTALS

A. Product data for each type of floor mat and frame specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop drawings showing layout and types of floor mat, full-scale sections of typical installations, details of patterns or designs, anchors, and accessories.

C. Samples for Architect’s initial selection of manufacturer’s full line of available colors for tread insert surface.

1.3 INFORMATIONAL SUBMITTALS

A. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain each type of floor mats from one source of a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual framed openings for mats by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid a delay of the Work.

1.6 WARRANTY

A. Provide manufacturer’s standard two year warranty on entrance floor mat and frame.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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A. Structural Performance: Design and fabricate floor mats and frames to support a uniform distributed load of at least 200 pounds per square foot.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Construction Specialties, Inc.
2. Mats Inc.
3. Reese Enterprises, Inc.
4. Pawling Corp.

2.3 MATS

A. Surface-Mounted Aluminum Linked-Tread Floor Mat: High-impact vinyl/acrylic tread rails with co-extruded soft-durometer cushions, joined mechanically by aluminum hinge rails; all materials shall be perforated to allow for drainage.

1. Tread Rail Spacing: 2 inches o.c.
2. Mat Depth: 7/16"
3. Aluminum: Extruded aluminum, ASTM B 221, alloy 6063-T6 or 6063-T5
4. Aluminum Finish: Powder coat paint in color as scheduled.
5. Tread Surface: Abrasive insert in color selected by Architect.
6. Basis of Design Product: "Pedimat M1” by Construction Specialties Inc., or equal.

2.4 FRAMES

A. General: Provide manufacturer's standard design of size and style to fit with mat type; complete with installation anchorages and accessories.

B. Recessed Level Base Mat Frame: 3/4"(19.1mm) deep recessed frame in 6063-T5 aluminum alloy with 1/4"(6.4mm) wide exposed surface.

1. Finish: Mill
2. Basis of Design Product: Aluminum Level Base Frame by Construction Specialties, Inc. or equal.

2.5 MISCELLANEOUS MATERIALS

A. Provide latex leveling screed material of type recommended by mat manufacturer.

2.6 FABRICATION

A. Shop-fabricate units of floor mat work to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal

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traffic lanes and note locations on shop drawings. Where possible, verify sizes by field measurement before shop fabrication.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by means of straight connecting pins.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor recesses for compliance with requirements for location, size, and minimum recess depth affecting installation of foot mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 INSTALLATION

A. Prepare substrate by applying latex leveling screed to ensure level base.

B. Install recessed frames and mats to comply with manufacturer's instructions at locations indicated and with top of frames and mats in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set mat tops at height for most effective cleaning action and coordinate top of mat surfaces with doors that swing across mats to provide clearance under door.

3.3 PROTECTION

A. Defer installation of floor mats until time of Substantial Completion for Project.

END OF SECTION 124813

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SECTION 142100 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes electric traction passenger/service elevators.

B. Related Sections include the following:

1. Division 03 Section for setting sleeves, inserts, and anchoring devices in concrete.
2. Division 04 Section for setting sleeves, inserts, and anchoring devices in masonry.
3. Division 05 Sections for the following:
   a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
   b. Machine beams.
   c. Structural-steel shapes for subsills and entrance frames that are part of steel frame.
   d. Pit ladders.
4. Division 09 Sections for finish flooring in elevator cars.
5. Division 26 Section for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
6. Division 26 Section for telephone service to elevators.
7. Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.

1.2 DEFINITIONS

A. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.3 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:

1. Car enclosures and hoistway entrances.
2. Operation, control, and signal systems

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure,

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relationships with other construction, and locations of equipment and signals. . Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- (75-mm-) square samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, including emergency generator, as shown and specified, are adequate for elevator system being provided.

B. Maintenance Manuals: Include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel. Submit for Owner's information at Project closeout.

C. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

D. Qualification Data: For Installer

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an experienced installer approved by elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Regulatory Requirements: In addition to local governing regulations, comply with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators" and Building Code of New York State.

C. Accessibility Requirements: In addition to local governing regulations, comply with ANSI A117.1-2017.

D. NFPA: Comply with applicable NFPA codes, and specifically with sections relating to electrical work and elevators.

E. Fire-Rated Door Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having

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jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

F. Design Criteria: The drawings and specifications indicate the cab clear inside dimensions, motor horsepower and hoistway dimensional requirements and other requirements of the electric traction elevator, and are based on the specific types and models indicated. Electric traction elevators by other manufacturers may be considered, provided deviations in dimensions are minor, and do not change the hoistway dimensions. Motor horsepower must be less than or equal to that specified or the proposer shall pay all costs associated with increasing electrical service to elevator as necessary. The burden of proof of equality is on the proposer.

1.6 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.7 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by manufacturer agreeing to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: 12 months from date of Acceptance.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Acceptance, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

1. Perform maintenance, during normal working hours.
2. Provide emergency 24-hour callback service.
   a. Response Time: Two hours or less.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide specified products of Schlindler or equivalent elevator manufactured by ThyssenKrupp, KONE or Otis.

2.2 MATERIALS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.

1. Provide machine-room-less type elevator.

B. Passenger Elevator Machines:

1. Gearless frequency controlled asynchronous machine AC motor with integral drive sheave and normal and emergency brakes. All bearings must be rated for a 20-year life span.
2. Side counterweight configurations shall use a rail mounted design.

C. Governor:

1. Manual reset from outside hoistway.
2. Mount to structural support channels, concrete machine room slab or guide rail as applicable.
3. Governor rope shall be steel with a diameter of 1/4" (6mm).

D. Suspension System: Non circular elastomeric coated suspension media with high tensile grade steel cords

E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Specification Section.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening

G. Car Frame and Platform: Welded steel units.

H. Finish Materials: Provide the following materials and finishes for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:

1. Satin Stainless Steel: ASTM A 666, Type 304, with No. 4, directional satin finish
2. Powder-Coated Steel Sheet: Cold-rolled steel sheet complying with

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ASTM A 366/A 366M, matte finish, stretcher-leveled standard of flatness. Provide with factory-applied powder coat paint finish; colors as scheduled.

3. Prime-Painted Steel Sheet: Cold-rolled steel sheet, ASTM A 366/A 366M, or hot-rolled steel sheet, ASTM A 569/A 569M, with factory-applied rust-inhibitive primer.
4. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type GP-50; color, texture, and pattern as selected by Architect.

2.3 OPERATION SYSTEMS

A. Passenger Elevators: Provide manufacturer's standard microprocessor operation system for each elevator or group of elevators as required to provide type of operation system indicated.

1. Single Elevator: Provide "selective collective automatic operation" as defined in ASME A17.1.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated

1. Loaded-Car Bypass: When car load exceeds a predetermined weight, car will respond only to car calls, not to hall calls. Predetermined weight can be adjusted.
2. Automatic Dispatching of Loaded Car: When car load exceeds a predetermined weight, doors will begin closing.
3. Nuisance Call Cancel: When car calls exceed a preset number while the car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
4. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. Maintain the car approximately level with the landing irrespective of its load
5. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to the door close button.
6. Automatic emergency recall and fire fighter's emergency service (Phase I fire service and Phase II car fire service in accordance with ASME A17.1); return to Ground Floor (designated floor), with alternate floor the First Floor.
7. Controls for emergency operation shall be located in each car.
8. Access at bottom landing with zoning.
9. Access at top landing with zoning.

2.4 SIGNAL EQUIPMENT

A. General: Provide signal equipment for each elevator or group of elevators with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, non-yellowing translucent plastic.

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B. Car Control Stations: Provide manufacturer's standard semirecessed or fully recessed car control stations. Mount in return panel adjacent to car door, if not otherwise indicated.

1. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.
2. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1.
3. Mount controls at heights complying with ANSI A117.1-2017.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and ANSI A117.1-2017. On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Car Position Indicator: For passenger elevator cars, provide illuminated-signal type, digital-display type, or segmented type, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

E. Hall Push-Button Stations: Provide one hall push-button station at each landing for each elevator or group of elevators, but not less than one station for each four elevators in a group. For each group of passenger elevators, locate between two elevators at center of group or at location most convenient for approaching passengers.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Provide units with direction-indicating buttons; two buttons at intermediate landings; one button at terminal landings.
3. Firefighters Phase I key switch shall be located at Ground Floor.

F. Combination Hall Lanterns/Hall Position Indicators: Provide illuminated-signal type or digital-display type, located above each hoistway entrance. Provide units with illuminated arrows, but provide single arrow at terminal landings.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
2. With each lantern, provide audible signals indicating car arrival and direction of travel, including floor passing signal.

G. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations with text and graphics according to ASME A17.1, Figure 2.27.9.

H. Fireman’s Warning Signal (Third Signal): Provide illuminated fireman’s hat which shall light in the event a fire is detected in the elevator machine room or hoistway per NFPA 72-6.15.3.9 and ASME A17.1-2.27.3.2.6.

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I. Controllers: Provide contact points in the controllers for fire alarm system interface.

J. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.

2.5 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with a uniform array of 33 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

1. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.6 ELEVATOR MONITORING SYSTEM

A. Remote Elevator Monitoring: Provide microprocessor controlled system that allows remote monitoring of elevators for maintenance needs and repair requests.

2.7 PASSENGER ELEVATOR CAR ENCLOSURES

A. General: Provide manufacturer's standard steel-framed car enclosures with nonremovable wall panels as required for wall panel finish specified, suspended ceiling, trim, accessories, access doors, doors, power door operators, sills (thresholds), lighting, and ventilation.

1. Wall Panels: Plastic laminate panels, in color, and pattern as selected by Architect.
2. Car Doors and Frames: Satin finish stainless steel.
   a. Fabricate car door frame integrally with front wall of car.
   b. Fabricate car with recesses and cutouts for signal equipment.
3. Luminous Ceiling: Satin finish stainless steel dropped ceiling with downlit round LED lights.
4. Flooring: By others as specified in Division 09 Section “Resilient Flooring and Accessories”.
5. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6 mm) thickness, mill finish.
6. Handrails: Round aluminum rails, clear anodized, at sides and rear walls.
7. Wall Protection Pads: Provide hooks and removable protection pads for interior of cab to completely cover walls, in color selected by Architect.

B. Emergency Light: Integrated emergency light in a module inclined 20 degrees from vertical, illuminating automatically upon loss of the building's normal power supply.

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C. Top of Car Access: Provide top of car access door complying with ASME/ANSI A17.1.

D. Car Fan: Provide top of car ventilation fan, one-speed, with key-operated switch in car control station

2.8 PASSENGER HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
2. Provide units bearing Underwriters' Laboratories "B" labels.
3. Comply with elevator manufacturer's requirements for elevator wall interface with hoistway entrance assembly.

B. Interlocks: Equip each hoistway entrance with an Underwriters' Laboratories "B" label approved type interlock tested as required by code. Design interlock to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by code and prevent opening the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.

C. Materials and Fabrication: Provide manufacturer's standards but not less than the following:

1. Stainless-Steel Frames: Formed from stainless steel sheet, with satin finish.
2. Stainless-Steel Doors: Flush, hollow-metal construction, fabricated from stainless steel with satin finish.
3. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6 mm) thickness, mill finish.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.9 SIGNAGE

A. Provide signage complying with Safety Code for Elevators and Escalators (ASME A17.1), ANSI A117.1-2017, and the Building Code of New York State.

2.10 PASSENGER/SERVICE ELEVATORS

A. Elevator No. 1

1. Type: One front opening gearless traction elevator
2. Basis of Design Product: Schlindler 3100.
3. Rated Load: 2100 lb.
4. Rated Speed: 100 fpm.
5. Operation System: Simplex operation, microprocessor control.

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6. Power Characteristics: 208V, 3 phase, 60 Hz.
7. Horsepower: 7 HP
8. Number of Stops: 2
9. Auxiliary Operations:
   a. Loaded-car bypass.
   b. Automatic dispatching of loaded car.
   c. Nuisance call cancel.
   d. Access at top landing with zoning.
   e. Access at bottom landing with zoning.
   f. Earthquake Emergency Operation: Comply with requirements in ASME A17.1.
   g. Automatic emergency recall and fire fighter's emergency service (Phase I fire service and Phase II car fire service in accordance with ASME A17.1); return to Ground Floor (designated floor), with alternate floor the Second Floor.
   h. Options: Provide all optional features specified or as required for code compliance.
   i. Elevator shall be tied into building emergency power system.

10. Car Enclosures: As follows:
    a. Inside Width: 5 '- 9-3/8"
    b. Inside Depth: 4' - 4-7/8".
    c. Inside Height: 7' - 9"
    d. Front Walls: Satin stainless steel with integral car door frames.
    e. Car Fixtures: Satin stainless steel.
    f. Car Walls: Powder-coated paint finish on steel panels.
       1) Color: Memphis Gray

.

    g. Door Faces (Interior): Satin stainless steel.
    h. Door Sills: Aluminum.
    i. Ceiling: Satin finish dropped stainless steel ceiling with round downlit LED lights.
    j. Handrails: Clear anodized aluminum round bar, at sides and rear walls.
    k. Floor: By others as specified in Division 09 Section “Resilient Flooring and Accessories”
    l. Ventilation: Fan.

11. Hoistway Entrances: As follows:
    a. Width: 3'-0"
    b. Height: 7'-0"
    c. Door Type: Two-speed side opening, right hand door
    d. Frames: Stainless steel.
    e. Doors: Stainless steel.
    f. Sills: Aluminum.

12. Hall Fixtures: Satin stainless steel
13. Additional Requirements: As follows:
    a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
    b. Provide protective blanket hooks on cab front and walls and one set of vinyl

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full-height protection pads in color selected by Architect.

c. Provide inspection switch and car top inspection station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

1. Install hoistway frames according to NFPA 80

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and direction of travel.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

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A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and governing regulations and agencies. All tests shall be witnessed by a qualified elevator inspector (QEI) retained by the Owner.

B. Operating Test: Load elevators to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machines during 30-minute test period. Record failure of elevators to perform as required.

1. Perform operating test specified above on one elevator of each type, capacity, speed, and travel distance.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operation, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.

B. Make a final check of each elevator operation with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

3.5 PROTECTION

A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Use same parts and supplies as used in the manufacture and installation of original equipment.
2. Provide protective coverings, barriers, devices, signs, and other procedures to protect elevators. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.
3. Provide services of an elevator operator to operate the elevator during construction for construction purposes once temporary enclosures are in place. Cost of operator’s services shall be bourne by Contractor.

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END OF SECTION 142100

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SECTION 144200 - WHEELCHAIR LIFTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes lift assemblies of the following type and application:

1. Type: Unenclosed, straight-through platform lift.

B. Electrical service to each lift, including fused disconnect switch, is specified in Division 26 sections.

1.2 DEFINITIONS

A. Lift assembly is defined to include driving machines, platforms, access panels, guide rails, drive system, buffers (if any), signals, control systems, electrical wiring, and devices necessary to provide specified or Code-required performance operations, safety, or security of complete lift assembly. Include self-supporting lift structure as indicated.

1.3 SUBMITTALS

A. Product Data: Manufacturer's complete technical product data and installation instructions for each item specified, indicating capacities, dimensions, performances, operations, safety features, controls, finishes, and similar information.

B. Shop Drawings: Plans, elevations, and details showing interfaces with other work including loading on structure, together with indication of required clearances.

C. Maintenance Manuals: Bound manuals, with operating and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information.

D. Inspection and Acceptance Certificates: Include operating permits as required by governing authorities for normal, unrestricted use of lifts.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer shall have not less than 10 years experience in the design and fabrication of vertical wheelchair lifts.

B. Installer Qualifications: Either the lift manufacturer or an installer approved by the manufacturer.

C. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

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D. Regulatory Requirements: Comply with ASME A18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."

E. Design Concept: The drawings indicate the size, configurations, and dimensional requirements of the vertical wheelchair lifts required and are based on the specific type and model indicated. Wheelchair lifts by other manufacturers may be considered provided deviations in dimensions and configurations of components are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 INSTRUCTION AND MAINTENANCE

A. Instruct Owner's personnel in proper operation and maintenance of lift. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions.

B. Maintenance: Starting at date of Substantial Completion, provide full maintenance of units for a period of 12 months on a quarterly site visit/preventive maintenance basis. Correct operational imperfections and restore or replace defective or deteriorated components and finishes. Use only genuine parts, components, and supplies as used in the manufacture and installation of original equipment.

1.6 WARRANTY

A. Warranty: Provide special project warranty, signed by Contractor, Installer and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of wheel chair lift during warranty period. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected and unsatisfactory conditions.

1. The warranty period is 2 years starting on date of substantial completion.

B. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide Basis of Design Products by Garaventa, or approved equal by one of the following:

1. American Stair-Glide Corporation.
2. The Cheney Company, Inc.
3. National Wheel-O-Vator Co, Inc.

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2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

B. Steel Tubing: Either cold- or hot-formed steel tubing.

1. Cold-Formed Steel Tubing: ASTM A 500.
2. Hot-Formed Steel Tubing: ASTM A 501.

C. Steel Pipe: ASTM A 53; standard weight (Schedule 40), unless otherwise indicated or required by structural loads.

D. Carbon-Steel Sheet: Either cold- or hot-rolled, commercial-quality carbon steel.

1. Cold Rolled: ASTM A 366 (ASTM A 366M).
2. Hot Rolled: ASTM A 569 (ASTM A 569M).

E. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (ASTM A 653M, Z275) coating designation, commercial quality.

F. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing structural members, guide rails, machines, and other lift components where installation of devices is specified in another Specification Section.

G. Expansion Anchors: Anchor-bolt-and-sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 10 times the load imposed as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.3 UNENCLOSED, STRAIGHT THROUGH PLATFORM WHEELCHAIR LIFTS

A. Basis of Design Product: Genesis Opal Model GVL-OP-60 by Garanventa, Lift, or approved equal.

B. Systems and Machinery: Provide lift system to comply with the following requirements:

1. Rated Capacity: 750 pounds.
2. Rated Speed: 10 ft. per minute.
3. Power Supply: 120 VAC, 20 Amp, 1 phase, 60 Hertz.
4. System Control Voltage: 24 VAC.
5. Drive Mechanism: Leadscrew drive. Self-lubricating acme screw drive
6. Motor: 2 HP.

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7. Platform: Minimum 12 gauge steel, with skid-resistant surface finish.
8. Platform Size: 36" x 48-7/8" (Standard).
9. Platform Configuration: Straight through, with front and rear openings.
10. Platform Side Panels: Full height solid infill panels fabricated of not less than 16 gauge galvanized steel.
11. Door/Gate: 36" wide door with power door/gate operator and interlock.
12. Grab Rail: Provide a grab rail on the platform in accordance with ANSI requirements for commercial applications.
13. Inserts: Provide required concrete inserts and similar anchorage devices required for the installation of structural members, guide rails, machines, and other components. Installation of such inserts and devices is specified in other divisions of the specifications.
14. Vertical Rise: 63 inches maximum lifting height.

C. Control System: Provide constant pressure up-down switch which is keylocked and meets the requirements of ASME A18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."

1. Provide solid-state control system to greatest extent of availability, supplemented with electromechanical equipment.
2. Electrical Interlocks: Provide unit with interlocks at all gates and doors (top, platform, and bottom) which will prevent operation of the lift unless gates/doors are secured.
3. Leveling Tolerance: Provide terminal stopping system at each extreme of travel and adjust to maintain level tolerance within 1/8 inch regardless of load size or direction of travel.
4. Limit Switches: Provide at both top and bottom extremes of travel.
5. Obstruction Sensors: Provide sensors to cut power and stop unit in the event of contact with foreign object within pathway of travel. Comply with Code.
6. Safety Device: Provide safety device to stop platform in event of overspeed condition or of breakage or slackening of suspension of support means.
7. Manual Lowering: Provide means and tool to manually lower platform in case of malfunction or power loss.

D. Station and Platform Controls:

1. Lower Landing Call Station: Push button wall mount with key operation and automatic controls.
2. Upper Landing Call Station: Push button wall mount with key operation and automatic controls.
3. Emergency Telephone: Platform shall be equipped with ADA compliant integrated telephone with a stainless-steel faceplate. Telephone shall operate in the event of power failure. A telephone line shall be supplied to the lift site as specified under Division 26

E. Ramps: Provide a stationary ramp of 16 gauge galvanized steel sheet with a slip resistant finish at lower landing for access onto the platform.

2.4 FINISHES

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A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to application and designations of finishes.

B. Steel and Iron Finishes: Prepare and finish iron and steel, including galvanized steel, as follows:

1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6, "Commercial Blast Cleaning," followed by a conversion coating of type suited to organic coating applied over it.
2. Prepare galvanized steel surfaces by removing dirt, grease, and other contaminants followed by a conversion coating of type suited to organic coating applied over it. Clean welds, mechanical connections, and abraded areas; and apply galvanizing repair paint to comply with ASTM A 780.
3. Powder-Coated Finish: Immediately after cleaning and pretreating, apply manufacturer's standard, polyester, powder coating complying with AAMA 605.2.
   a. Color and Gloss: As selected by the Architect.

PART 3 - - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations and approved shop drawings for work during installation.

B. Code Compliance: The wheelchair lift installations shall conform to all applicable regulatory requirements including ASME A17.1 and ASME A18.1

C. Alignment: Coordinate runway doors with platform travel and positioning, for accurate alignment and minimum clearance between platform, runway door, sills, and door frame at each landing.

D. Position sills accurately with floors or counters, raised slightly above adjoining surface to minimize intrusion of dirt and spillage into runway. Coordinate with other trades to ensure that sills, or lower member of frames, are solidly grouted (no voids) with a nonstaining, nonshrinking grout.

E. Adjust stops for accurate leveling at each landing, within specified tolerances.

F. Lubricate operating parts of lift, including drive mechanism, guide rails, safety devices, and hardware.

3.2 FIELD QUALITY CONTROL

A. Test operate lift continuously between lowest and highest landings served, lifting full rated capacity load for a minimum period of 30 minutes. Readjust stops and other devices and signal equipment for accurate landings and operation of system after completion of test.

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B. Perform tests in compliance with ASME A17.1 or A18.1 and as required by authorities having jurisdiction.

C. Perform tests with Architect, Owner, and Contractor present.

3.3 DEMONSTRATION

A. Instruct Owner's maintenance personnel in the proper use, operation, and maintenance of lifts. Review emergency provisions, including access and procedures to be followed in checking for sources of operational failures or malfunctions. Confer with Owner on requirements for a complete maintenance program.

B. Check each lift operation with Owner's maintenance personnel present before time of Substantial Completion. Determine that control system, operating components, and safety devices are functioning properly.

END OF SECTION 144200

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SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION 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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

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2.2 STACK-SLEEVE FITTINGS

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. Jay R. Smith Mfg. Co.
2. Zurn Industries, LLC.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

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. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Proco Products, Inc.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

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2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, 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 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

4. Sleeves for building service piping shall be one nominal pipe size larger than the service pipe.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Install sleeves in seismic applications to provide adequate clearance according to NFPA 13 recommendations unless otherwise indicated.
4. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

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E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Install fittings in seismic applications to provide adequate clearance according to NFPA 13 recommendations unless otherwise indicated.
3. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing.
4. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
5. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
6. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

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3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves or Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves or Sleeve-seal fittings.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves or Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping [All Sizes]: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping [All Sizes]: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or Stack-sleeve fittings or Sleeve-seal fittings.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 210517

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SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION 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. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

2. Escutcheons for Existing Piping:

   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
   g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.

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h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

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SECTION 210523 - GENERAL-DUTY VALVES FOR FIRE PROTECTION 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. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Trim and drain valves.

1.3 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

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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.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

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D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

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. NIBCO INC.
2. Victaulic Company.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

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2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

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. Fivalco Inc.
2. Globe Fire Sprinkler Corporation.
3. Milwaukee Valve Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze or Stainless steel with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

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. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. Kennedy Valve Company; a division of McWane, Inc.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer or Grooved-end connections.

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2.5 CHECK VALVES

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. NIBCO INC.
2. Victaulic Company.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

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. Milwaukee Valve Company.
2. NIBCO INC.
3. United Brass Works, Inc.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

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:

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1. NIBCO INC.
2. Victaulic Company.
3. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved or Threaded.

2.8 NRS GATE VALVES

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. American Cast Iron Pipe Company.
2. NIBCO INC.
3. Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved or Threaded.

2.9 TRIM AND DRAIN VALVES

A. Ball Valves:

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:

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a. Apollo Valves; Conbraco Industries, Inc.
b. NIBCO INC.
c. Potter Roemer LLC.

2. Description:

a. Pressure Rating: 175 psig or 300 psig.
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.
d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

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. Fire Protection Products, Inc.
b. NIBCO INC.
c. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig or 300 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

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. NIBCO INC.
b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig or 300 psig.

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b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

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 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
2. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
3. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

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C. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above the pipe center.

E. Install valves in position to allow full stem movement.

F. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

G. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

H. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

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SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

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1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.

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2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. B-line, an Eaton business.
   b. Flex-Strut Inc.
   c. Unistrut; Part of Atkore International.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: one of the following Pregalvanized G90, Electroplated zinc, Hot-dip galvanized.
9. Paint Coating: Green epoxy, acrylic, or urethane.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. CADDY; a brand of nVent.
   c. Carpenter & Paterson, Inc.
   d. Empire Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Select for applicable load criteria.

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6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: one of the following Pregalvanized G90, Hot-dip galvanized.
9. Paint Coating: Green epoxy, acrylic, or urethane.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. National Pipe Hanger Corporation.
3. Pipe Shields Inc.
4. Piping Technology & Products, Inc.
5. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material: one of the following Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi, ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

F. Use thermal hanger shield for all insulated piping. This typically occurs where piping is heat traced.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.
d. Simpson Strong-Tie Co., Inc.

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B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-line, an Eaton business.
b. Hilti, Inc.
c. ITW Ramset/Red Head; Illinois Tool Works, Inc.

2. Indoor Applications: Zinc-coated or Stainless steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

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L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

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3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1” inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

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D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications. (this includes all outdoor and garage applications)

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

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SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Brady Corporation.

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b. Craftmark Pipe Markers.
c. Marking Services, Inc.
d. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch or aluminum, 0.032-inch thick, with predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Red.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Brady Corporation.
b. Craftmark Pipe Markers.
c. Marking Services, Inc.
d. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch or 1/8-inch thick, with predrilled holes for attachment hardware.

3. Letter Color: White.
4. Background Color: Red.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where

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equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch or 1/8-inch thick, with predrilled holes for attachment hardware.

C. Letter Color: Yellow.

D. Background Color: Black.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

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B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping with at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

F. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

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. Craftmark Pipe Markers.
b. Marking Sevices Inc.

2. Lettering Size: Size letters according to ASME A13.1 for piping with at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.

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2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch or aluminum, 0.032-inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain, beaded chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

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3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

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B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 1-1/2 inches, round.
b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
c. Dry-Pipe Sprinkler System: 1-1/2 inches, round.
d. Foam-Water System: 1-1/2 inches, round.
e. Clean-Agent Fire-Extinguishing System: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

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SECTION 211119 - FIRE-DEPARTMENT CONNECTIONS

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. Exposed-type fire-department connections.
2. Flush-type fire-department connections.
3. Yard-type fire-department connections. (Not Used)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. Guardian Fire Equipment, Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

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F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Minimum of Two. Contractor shall provide one inlet for each 250 GPM of system rated capacity.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR or AUTO SPKR & STANDPIPE or STANDPIPE."

L. Finish: Polished chrome plated or Rough brass or bronze.

M. Outlet Size: NPS 4 unless otherwise indicated.

2.2 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

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. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. Potter Roemer LLC.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal.

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K. Number of Inlets: Minimum of Two. Contractor shall provide one inlet for each 250 GPM of system rated capacity.

L. Outlet Location: Back unless otherwise indicated

M. Escutcheon Plate Marking: Similar to "AUTO SPKR OR AUTO SPKR & STANDPIPE OR STANDPIPE."

N. Finish: Polished chrome plated or Rough brass or bronze.

O. Outlet Size: NPS 4 unless otherwise indicated.

2.3 YARD-TYPE FIRE-DEPARTMENT CONNECTION (NOT USED)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Elkhart Brass Mfg. Co., Inc.
2. Guardian Fire Equipment, Inc.
3. Potter Roemer LLC.

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 175 psig minimum 300 psig.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Minimum of Two. Contractor shall provide one inlet for each 250 GPM of system rated capacity.

K. Sleeve: Brass.

L. Sleeve Height: 18 inches.

M. Escutcheon Plate Marking: Similar to "AUTO SPKR or AUTO SPKR & STANDPIPE or STANDPIPE."

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N. Finish, Including Sleeve: Polished chrome plated or Rough brass or bronze.

O. Outlet Size: NPS 4 unless otherwise indicated

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 fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support.

C. Install two pipe bollards around each fire-department connection where subject to vehicular damage. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

E. All exposed pipe and fittings, (that are not brass or chrome), shall be painted red.

END OF SECTION 211119

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SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

B. High Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175-psig but not higher than of 300-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.

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2. Include diagrams for power, signal, and control wiring.

C. DELEGATED-DESIGN SUBMITTAL: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Licensed Professional Engineer, (in the state where work is being performed), responsible for their preparation. This shall include fire hydrant flow test results and data, sprinkler system and standpipe system hydraulic calculations.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water, sanitary and storm piping.
2. Compressed air and medical gas piping.
3. HVAC ductwork and piping.
4. Items penetrating finished ceiling include the following:

   a. Lighting fixtures and ceiling mounted controllers.
   b. Air outlets and inlets.
   c. Fire Alarm initiating and signaling devices.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations and seismic calculations.

D. Welding certificates.

E. Fire-hydrant flow test report, recent within one (1) year.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and fire pump test reports.

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 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.

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1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Architect, Construction Manager, Owner and Engineer no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Architect's, Construction Manager's, Owner's and Engineer’s written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13 as amended by Appendix Q (BCNYC).

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 300-psig working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

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1. Available fire-hydrant flow test records: Refer to Fire Protection contract drawings.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications: According to NFPA 13 recommendations unless otherwise indicated.

3. Minimum Density for Automatic-Sprinkler Piping Design: According to NFPA 13 recommendations unless otherwise indicated.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler: According to NFPA 13 recommendations unless otherwise noted.

E. Total combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated.

F. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, schedule 40 Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME 16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch thick or ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

   a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

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2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

J. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Anvil International.
b. Tyco Fire Products LP.
c. Victaulic Company.

2. Pressure Rating: 175-psig minimum or 300-psig where exposed to higher system pressures.

3. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 300-psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Automatic (Ball Drip) Drain Valves:

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. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products LP.

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2. Standard: UL 1726.

3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.4 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum or 300 psig.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

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. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum or 300 psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

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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. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Tyco Fire Products LP.
   b. Victaulic Company.
   c. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum or 300 psig.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

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. CECA, LLC.
   b. Corcoran Piping System Co.
   c. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum or 300 psig.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

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F. Flexible Sprinkler Hose Fittings: Not permitted in NYC

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. FlexHead Industries, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum or 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.5 SPRINKLERS

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. Reliable Automatic Sprinkler Co., Inc. (The).
2. Tyco Fire Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards:

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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. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.6 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

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. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 8-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Water-Flow Indicators:

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. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Viking Corporation.
   d. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.

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4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

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. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Tyco Fire Products LP.
   d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

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. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Potter Electric Signal Company, LLC.
   c. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 PRESSURE GAGES

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. AGF Manufacturing Inc.

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2. AMETEK, Inc.
3. Brecco Corporation.

B. Standard: UL 393.
C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
D. Pressure Gage Range: 0 to 300 psig.
E. Label: Include "WATER" label on dial face.
F. Body: aluminum, or steel

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article. Flow test utilized for calculations shall be recent within one (1) year.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Engineer before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

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I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping." Sleeves for building service shall be one nominal line size greater than the service pipe.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

S. Paint all sprinkler piping valves and accessories, (that are not brass or chrome), with red enamel.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

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C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

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1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. Comply with requirements for identification specified in Section 210553 "Identification for Fire-Suppression Piping and Equipment".

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

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3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain sprinkler system and components.

3.10 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints. Where piping between fire department connection and check valve is routed below grade, piping and fittings shall also be externally coated and wrapped per AWWA C203 or C105.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 1-1/2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and Larger, shall be one of the following:

1. Standard weight black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. High-pressure, wet-pipe sprinkler system, [All Sizes], shall be one of the following:

1. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

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3.11 SPRINKLER SCHEDULE

A. Use sprinkler types as indicated on Fire Protection contract drawings.

END OF SECTION 211313

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SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. These basic requirements apply to all Division 22000 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all Plumbing and related work for this project, as required by the contract documents.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 REFERENCES

A. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.
B. ASPE - American Society of Plumbing Engineers.
C. UL - Underwriters Laboratory.
D. NFPA - National Fire Protection Association.

1.04 REGULATORY REQUIREMENTS

A. NY State Plumbing code 2020
B. NY State Fuel Gas Code 2020
C. NY State Energy Conservation Code 2020

1.05 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

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1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.07 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all Plumbing work indicated on plan and in the specifications and related work including but not limited to the following:

- Sump Pumps
- Domestic Water Recirculation Pumps
- Domestic Hot Water Heaters and Expansion tanks
- Plumbing Fixtures
- Piping, Valves and fittings and specialties
  - Domestic systems
  - Drain, Waste, and Vent
  - Gas
- Hangers and Supports
- Compressed air pipe valves and fittings
- Backflow Preventers
- Equipment Insulation
- Pipe Insulation
- Identification
- Coordination
- Phasing
- Shop Drawings
- As-Built Drawings and Maintenance Manuals
- Warrantees

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Where corrosion can occur, appropriate corrosion resistant materials and assembly methods must be used including isolation of dissimilar metals against galvanic

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interaction. Resistance to corrosion must be achieved by the use of the appropriate base materials. Coatings shall be restored to only when specifically permitted by the Specification.

C. Construct all equipment in accordance with requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

E. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with manufacturer's recommendations.

F. Provide all controls, wiring, piping, valves, accessories and other components necessary to make all systems complete and operable.

G. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

3.2 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 1)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of the all items listed in the following paragraph.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all equipment noted and scheduled on plans including but not limited to the following:

- Sump pumps
- Domestic Water Recirculation Pumps
- Domestic Hot Water Heaters and Expansion tanks and specialties
- Hot water heater
- Plumbing Fixtures
- Compressed air pipe valves and fittings
- Undercarriage truck wash
- Piping, Valves and fittings and specialties
  - Domestic systems
  - Drain, Waste, and Vent
  - Gas
- Hangers and Supports
- Backflow Preventers

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- Equipment Insulation
- Pipe Insulation
- Hangers and Inserts
- Floor Drains
- Insulation
- Piping Layout (3/8 scale)
- Controls

D. The contractor shall, upon award, submit a schedule for the engineers review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manor as the project progresses in accordance with the Construction manager or General contractor's work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

E. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

F. Coordination shop drawings shall indicate all new lights, walls, piping, ductwork, structural elements, existing work, etc. and dimension locations of plumbing piping including elevations in relation to these items.

G. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications.

H. Where substitutions are submitted for approval the review shall be for general performance comparison to the specified product. Products shall not be reviewed for size, clearance or coordination with other trades. Coordination with other trades shall be the responsibility of the contractor. And changes to existing conditions or changes required to the work of other trades such as a result of substituted material or equipment approved or not shall be the responsibility of this contractor.

I. Approval of shop drawings

1. The Contractor shall be specifically responsible for checking equipment dimensions and clearances and confirming that equipment will fit into the designated space and connect properly to adjoining equipment and/or materials.

2. Submittals marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Amend and Resubmit", corrected drawings must be resubmitted for final review.

3. Submittals marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

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4. Submittals marked "Rejected" or "Amend and Resubmit" shall include a specific written response to the engineer's comments. Resubmission of a submittal without a written response to the engineer's comments will be considered incomplete and shall be returned un-reviewed.

3.3 CHARTS AND TAGS

A. The Contractor shall provide three sets of charts and diagrams of all piping systems indicating the number and location of valves, etc.

B. All valves, and controls shall be designated with brass tags. Refer to section 22 05 23 Identification for HVAC Piping and equipment

C. General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

3.5 FEES & PERMITS

A. The Contractor shall obtain all permits and pay all fees required for his work.

3.6 PAINTING

A. All piping shall be painted in colors conforming with OSHA Standards.
B. All nuts bolts and fasteners shall be galvanized steel or nickel-plated. Supports and hangers shall be painted.

3.7 RIGGING

A. Furnish all labor, materials and equipment required to rig equipment and materials.

D. The rigger shall secure any necessary permits and comply with all applicable Federal, State and local safety regulations. A copy of permits to be kept at both the project site and Engineer's Office.

E. The rigger shall have a minimum of five (5) years of practical experience and hold a master riggers license if required.

F. The procedure for rigging shall be submitted to the Engineer for review. All possible precautions should be taken to prevent damage to the structure, streets, sidewalks, curbs, lawns, etc.

3.8 CUTTING AND PATCHING

A. All cutting and patching required for piping, etc., passing through walls, floors, and roof shall be provided by the General Contractor under this contract unless otherwise noted. This Contractor shall be responsible for any damage done to the structure due to his negligence.

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B. Patching materials and application shall match existing construction.

C. Where applicable, new holes for piping installation shall be core drilled.

D. Pipe Sleeves & Fire-stopping

1. Provide for all pipes and other elements passing through floors, walls, partitions and structural elements, sleeves as specified. Sleeves shall be of adequate diameter to allow for a minimum of 3/4 inches clear all around sleeve and pipe.
2. Where pipes penetrate fire rated assemblies, or where holes or voids are created to extend systems through fire rated assemblies (walls, floors, ceilings, structure, etc.); sleeves and fire-stopping systems shall be installed.

G. Furnish access doors, to the General Contractor for installation where required in finished walls, partitions and the like for access to junction boxes, controls, valves, etc, concealed behind finished construction.

3.9 PROTECTION-COORDINATE WITH DIVISION 1

A. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring on to adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for pipe, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and water tight.

G. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together.

3.10 EQUIPMENT SUPPORTS

A. Provide supplementary steel dunnage, curbs, angle iron stands, etc., to properly set and install all equipment, including supports necessary to properly pitch piping.

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3.11 WELDING SOLDERING BRAZING

A. All equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

C. Provide all temporary exhaust, and ventilation air systems required during welding operations as required by OSHA. At no time shall the owner's new or existing HVAC equipment be used for ventilation during construction.

2.12 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all piping and roof drains.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1.

3.13 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.14 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

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C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.15 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.16 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction to suit conditions. Provide all labor and material to facilitate installation.

3.17 COOPERATION WITH OTHER TRADES / PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

D. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

E. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipments, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, roof drains, etc.

F. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the PLUMBING contractor shall submit a schedule in writing to the Architect and owner for approval. There shall be no shut downs of any systems without prior written approval from the owner. The contractor shall include in his bid all costs associated with providing temporarily piping, pumps, hot water heaters, to maintain operations outside the area of work while work is being performed.. It shall also be noted that piping will have to be extended through the other areas in order to reach the area(s) under construction as part of this work. The contractor shall include in his bid all provisions to perform such phasing work. This note is typical for phases.

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3.18 CLEANING

A. It is the intent of the contract documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.19 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer.

3.20 FIRE PREVENTION DURING HOT WORK

A. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully-charged, operable portable fire extinguisher to each fire watcher.

B. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

C. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.21 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

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E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks. Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the days work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall cleanup the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully-charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.22 USE OF OWNERS EQUIPMENT

A. The contractor shall not use any the owner’s HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation, or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

END OF SECTION

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SECTION 22 05 17 SLEEVES AND SLEEVE SEALS 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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 80, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 80, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

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:

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1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel, Stainless steel, Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 63,3 Stainless steel, Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

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PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls. Sleeves for building service piping shall be one nominal line size larger than the service pipe.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. 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 for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

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5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves Sleeve-seal fittings.

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b. Piping NPS 6 and Larger: Cast-iron pipe sleeves, or Steel pipe sleeves with Sleeve-seal fittings.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch minim annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves or Stack-sleeve fittings.
b. Piping NPS 6 and Larger: Steel pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

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SECTION 22 05 18 ESCUTCHEOUNS 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. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

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B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

2. Escutcheons for Existing Piping: (not used)

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
f. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

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SECTION 220519 - METERS AND GAGES 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. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

B. Related Requirements:
1. Section 221119 "Domestic Water Piping Specialties" for water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

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PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. WATTS.
3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

2.2 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

G. Window: Plain glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.

2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.

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4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

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2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Standard: ASME B40.100.
   2. Case: Liquid-filled AND Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
   3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
   4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
   5. Movement: Mechanical, with link to pressure element and connection to pointer.
   6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
   7. Pointer: Dark-colored metal.
   8. Window: Glass.
   9. Ring: Brass OR Stainless steel.
   10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Standard: ASME B40.100.
   2. Case: Liquid-filled and Sealed type; cast aluminum or drawn steel; 4-1/2-inch OR 6-inch nominal diameter with back or front flange and holes for panel mounting.
   3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
   4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
   5. Movement: Mechanical, with link to pressure element and connection to pointer.
   6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
   7. Pointer: Dark-colored metal.
   8. Window: Glass.
   9. Ring: Stainless steel.
   10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: or NPS 1/2, ASME B1.20.1 pipe thread.

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D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.9 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Dwyer Instruments, Inc.
3. Ernst Flow Industries.
4. John C. Ernst Co., Inc.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 150 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.
4. Downstream of back flow preventer.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

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3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 PRESSURE GAGE AND THERMOMETER SCHEDULE

A. Install large size thermometers where ever space is available. Where space is limited or use compact style.

B. Install all pressure gages locally unless space does not permit or the location is not readily visible. Then use remote reading pressure gage and install in location accessible and readily visible, as close to the point of reading as possible.
   1. Test plug with EPDM self-sealing rubber inserts.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

C. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F.

3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

C. Scale Range for Domestic Water Piping: 0 to 300 psi.

END OF SECTION 220519

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SECTION 22 05 29 GENERAL-DUTY VALVES OR 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 lift check valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Iron gate valves.
6. Bronze globe valves.
7. Iron globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 SUBMITTALS

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

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1.5 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.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. Every pipe, fixture, and fitting used to convey water for potable use shall contain less than 0.25% of lead by weight according to lead free law "reduction of lead in drinking water act", nsf/ansi standard 372.

1.6 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 gate valves closed to prevent rattling.
4. Set ball 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.

C. 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. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

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D. Valve Actuator Types:
   1. Handwheel: For valves other than quarter-turn types.
   2. Handlever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch 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.

F. 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.

G. 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. Description:

      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Seats: PTFE or TFE.
      g. Stem: Brass.
      h. Ball: Chrome-plated brass.
      i. Port: Full.

B. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

   1. Description:

      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Seats: PTFE or TFE.
      g. Stem: Brass.

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h. Ball: Chrome-plated brass.
i. Port: Regular.

2.3 IRON, GROOVED-END BUTTERFLY VALVES

A. Iron, Grooved-End Butterfly Valves:

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. Kennedy Valve; a division of McWane, Inc.
   b. Shurjoint Piping Products.
   c. Tyco Fire Products LP; Grinnell Mechanical Products.
   d. Victaulic Company.

2. Description:

   a. Standard: MSS SP-67, Type I.
   b. CWP Rating, NPS 8 and Smaller: 300 psig.
   c. CWP Rating, NPS 10 and Larger: 200 psig.
   d. Body Material: Coated, ductile iron.
   e. Stem: Two-piece stainless steel.
   f. Disc: Coated, ductile iron.
   g. Seal: EPDM.

2.4 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

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. Crane Valves.
   b. Jenkins Valves.
   c. Stockham Division.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Disc: Bronze.

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2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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. Crane Valves.
   b. Jenkins Valves.
   c. Stockham Division.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Disc: Bronze.

2.6 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

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. Crane Valves.
   b. Jenkins Valves.
   c. Stockham Division.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   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.

B. Class 125, NRS Bronze Gate Valves:

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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. Crane Valves.
   b. Jenkins Valves.
   c. Stockham Division.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig.
   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.

2.7 IRON GATE VALVES

A. Class 150, OS&Y, Iron Gate Valves:

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. Crane Valves.
   b. Jenkins Valves.
   c. Stockham Division.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

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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. Crane Valves.
   b. Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 500 psig.
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

2.8 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. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200psig.
   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: Bronze, PTFE, or TFE
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

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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. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-85, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Packing and Gasket: Asbestos free.

2.10 LUBRICATED PLUG VALVES

A. Plug valves are specified in Specification section 221114 Natural gas piping

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.

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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 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.

F. All valves used in any system shall have a pressure class that exceeds the pressure of the system it is installed in.

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 on plan, use the following:

1. Shutoff Service: Ball, butterfly**,** or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or ball valves.
4. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
   b. NPS 2-1/2 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 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: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

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3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass Valves: May be provided with lead free solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass with brass trim. Class 150
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM, NBR seat, aluminum-bronze disc.
3. ron Gate Valves: Class 150.

3.6 SANITARY WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.
3. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Gate Valves: Class 150.
3. Iron Swing Check Valves: Class 150.
4. Iron Globe Valves: Class 150.

END OF SECTION 220523

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SECTION 22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

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

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B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

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2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. National Pipe Hanger Corporation.
   2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
   3. Rilco Manufacturing Co., Inc.
   4. Other manufacturers offering equivalent products.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

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C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.8 VIBRATION ISOLATION HANGERS

A. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

1. Pipe Stand: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger

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and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

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B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections**.**

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

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E. Use carbon-steel pipe hangers and supports, and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

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18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

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10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.

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b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

9. Install vibration isolation hangers on all piping connected to motor driven equipment for a distance of 20' or the first two hangers.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

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PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass 0.032-inch, stainless steel 0.025-inch, aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black, Blue, Red, White, Yellow. As per ANSI depending on service
3. Background Color: Black, Blue, Red ,White, Yellow as per ANSI depending on service
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black, Blue, Red, White, Yellow as per ANSI depending on service
3. Background Color: Black, Blue, Red, White, Yellow ANSI depending on service
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

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2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

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1. Stencil Paint: Exterior, gloss, black unless otherwise indicated. Paint may be in pressurized spray-can form.
2. Identification Paint: Exterior, enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

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B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feetalong each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

3. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

4. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black
   b. Letter Color: White

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3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches round.
   b. Hot Water: 1-1/2 inches round.
   c. Sanitary waste and storm drainage: 1-1/2 inches round.

2. Valve-Tag Color:

   a. Cold Water: Green.
   b. Hot Water: Green.
   c. Sanitary waste and storm drainage: Natural.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.
   c. Sanitary waste and storm drainage: white.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

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SECTION 22 07 19 PLUMBING PIPING INSULATION AND JACKETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
1. Section 221116 "domestic water piping."
2. Section 22 13 16 sanitary waste and vent piping
3. Section 22 13 19 sanitary waste piping specialties

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.

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3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

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B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. Pittsburgh Corning Corporation; Foamglass.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.

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6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

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. Ramco Insulation, Inc.; Super-Stik.

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B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

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. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
4. Wet Flash Point: Below 0 deg F .
5. Service Temperature Range: 40 to 200 deg F.

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D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

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. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SEALANTS

A. Joint Sealants:

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1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.

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5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

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b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

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. Pittsburgh Corning Corporation; Pittwrap.
b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.

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4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

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2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

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. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

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. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
   b. McGuire Manufacturing.
   c. Truebro; a brand of IPS Corporation.
   d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

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. Truebro; a brand of IPS Corporation.
   b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

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2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

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H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

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2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

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2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

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2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

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C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

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2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

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3.10 FINISHES

A. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

B. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Smaller than NPS 1 ½”: Insulation shall be one of the following:

a. Cellular Glass: ½ inches thick.
b. Flexible Elastomeric: ½” inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

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2. NPS 1 1/2 and Larger: Insulation shall be one of the following:

   a. Cellular Glass: 1” inches thick.
   b. Flexible Elastomeric: 1” inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1” inch thick.

B. Domestic Hot and Recirculated Hot Water: (T < 140° F)

1. Smaller than NPS 1 ½”: Insulation shall be one of the following:

   a. Cellular Glass: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1 ½” and Larger: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1-1/2 inches thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. All Sanitary waste, storm and domestic piping in garages or areas not heated:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Cellular Glass: 2” inches thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures not concealed by millwork:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Flexible Elastomeric: 1/2 inch thick cold water and drain, 1” hot water
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick old water and drain, 1” hot water
   c. Jacket with protective shielding guards. Refer to section 2.9

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. ASJ

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D. Piping, Exposed:

1. <u>All</u> exposed sanitary, waste, storm, hot water cold water, and vent piping and fittings which are exposed to view in public areas, particularly the equipment bay or second floor shall be completely covered with white Zeston 2000 PVC insulated piping and fitting covers. Apply as per manufacturer with Perma Weld adhesive. All labels and flow arrows shall be applied over PVC jacket

END OF SECTION 220719

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SECTION 22 11 14 – NATURAL GAS AND PROPANE 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. 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: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

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1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping valves and 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. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 3/8 inch per foot.
2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Qualification Data: For qualified professional engineer.

E. Welding certificates.

F. Field quality-control reports.

G. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 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.

1.7 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.

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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.

1.8 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 Construction Manager and Owner no fewer than one week in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Construction Manager's and Owner's written permission.

1.9 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 Division 08 Section "Access Doors and Frames."

C. Part 2 specifies general descriptions and minimum standards for pipe valves and fitting. All pipes valves fittings and specialties shall meet the requirements of the local utility and shall be listed and approved for use by the local utility.

D. The contractor shall be responsible for all utility and or gas supplier coordination. This will include but is not limited to field supervision by the utility, applications to the utility for service. Submit application, arrange field meetings and inspections as required.

E. HDPE piping fusion welding shall only be performed by contractors having current certification, (by the utility), for both personal and equipment. Before service work begins determine service gas pressure and obtain service layout from the utility. Required gas service pressure shall be coordinated with equipment requirements. (not applicable to this project).

F. This section pertains to the building above ground gas piping only. Above ground piping shall terminate outside the building in a location indicated on plan with service shut off valve. Refer to site plumbing specification for underground piping and regulators requirements.

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PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS, (**Above ground piping only)**

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.
5. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.
        2) Smith-Blair, Inc.
        3) Other manufacturers offering similar products.

    b. Steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. 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.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Corrugated stainless-steel tubing with polymer coating.
3. Operating-Pressure Rating: 0.5 psig.

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4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches.
7. Corrugated Stainless Steel Piping (CSST) installation is not permitted on distribution piping in New York City.

B. 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. 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.

2.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
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.

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5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
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.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

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. 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.
9. Listing: Valves NPS 1 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.

D. Bronze Plug Valves: MSS SP-78.

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. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.
   c. .

2. Body: Bronze, complying with ASTM B 584.

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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.
7. Listing: Valves NPS 1 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.

E. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

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. 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.
9. Listing: Valves NPS 1 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.

2.5 AUTOMATIC GAS SHUTOFF VALVES, (kitchen)

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33. and UL listed guide #YRPV2.

1. CWP Rating: 125 psig.
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 where indicated. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
6. Body; Aluminum
7. Seals and disc; NBR
8. Core tube; 305 stainless steel
9. Core and plugnut; 430F stainless
10. Springs; 302 stainless

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11. Valves shall be normally closed, cable operated and held open. Coordinate operating mechanism with fire protection contractor and equipment. Mechanism shall be designed to close valve when cable is pulled or released as required

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38. and UL listed guide #YRPV2.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves where indicated.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
5. Body; Aluminum
6. Seals and disc; NBR
7. Core tube; 305 stainless steel
8. Core and plugnut; 430F stainless
9. Springs; 302 stainless
10. Valves shall be normally closed, cable operated and held open. Coordinate operating mechanism with fire protection contractor and equipment. Mechanism shall be designed to close valve when cable is pulled or released as required.

2.6 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 and smaller; flanged for regulators NPS 2-1/2 and larger.
5. All appliance regulators shall be “lock up” type

B. Service Pressure Regulators: Comply with ANSI Z21.80.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Meter Company.
   b. Fisher Control Valves and Regulators; Division of Emerson Process Management.

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.

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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.

2.7 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   f. Wilkins; a Zurn company.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric 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. 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 minimum at 180 deg F.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

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D. Dielectric-Flange Insulating Kits:

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. 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.
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.

2.8 LABELING AND IDENTIFYING

A. In accordance with ASME and or local utility requirements.

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 and the New York State Fuel Gas Code to determine that gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the New York State Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 requirements for installation and purging of natural-gas piping.

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B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install fittings for changes in direction and branch connections.

D. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the New York State Fuel Gas Code 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 piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-regulator outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

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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 long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

M. Extend relief vent connections for service regulators to outdoors and terminate with weatherproof vent cap.

N. 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.

O. 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. 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.

2. 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.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

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3.5 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.

3.6 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.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

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B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, interior and 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).
d. Color: yellow.

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C. Paint exposed, interior metal piping, valves, service regulators, and piping specialties, except components, with factory-applied paint or protective coating.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the New York 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.

E. Aboveground natural-gas 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.

3.13 PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. PIPE SIZE AND PRESSURE LIMITATION FOR GAS PIPING

PSIG	Gas Pipe Installation
In Excess of ½ psig - 5 psig	Gas distribution pipe operating size 4-inch or larger must be welded.
In Excess of 5 psig	All gas distribution pipes sizes operating above 5 psig must be welded.
All piping 4-Inch or larger operating in excess of 5 psig must be butt-welded, Subject to radio-graphed	
Threaded piping may be used up to 4-inch at pressure no greater than ½ psig.	

B. Aboveground, branch piping smaller than 4” NPS and less than ½ psi shall be the following:

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1. Steel pipe with malleable-iron fittings and threaded joints.

C. All welded distribution piping shall be one of the following:
   1. Steel pipe with wrought-steel fittings and welded joints.

D. Underground, piping shall be one of the following: (NOT APPLICABLE)
   1. Steel pipe with wrought-steel fittings and welded joints.
   2. HDPE pipe and Fittings with fusion welded joints (NOT APPLICABLE)

E. All piping buried under buildings shall be in containment piping; (NOT APPLICABLE)
   1. Containment Conduit for gas pipe: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
   2. Containment Conduit for gas 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.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at regulator 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 and larger at service regulator 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 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 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 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.

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4. recirculation. Gas piping shall be in accordance with ANSI Z21.30 or Z83.1 (where applicable) and in accordance with the Public Service Commission Regulations NYCRR, Part 255 and the Federal Department of Transportation, Part 192.

F. BUILDING GAS PRESSURES

1. The allowable gas pressures within areas of the school building, other than the Boiler Room, (after the meter and/or regulators) will be the normal 1/2 psig or less service.

2. The allowable gas pressures within the Boiler Room, after the meter and/or regulators, may be up to 2 psig. Normally above 1/2 psig is only required for use in the Boiler Room. It will not be ordinary that gas pressure above 2 psig will be required and requests for utilization of gas pressures above 2 psig pressures will only be considered for approval upon formal presentation for such a request by the consulting engineer of technical reasons to the Office of Facilities Planning.

3. Pressure switches, pressure regulators, and other equipment requiring atmospheric pressure to balance a diaphragm shall be suitably vented to function properly. Over pressure relief valves, normally open vent solenoids, and other similar equipment shall be suitably vented to function properly and operate safely.

4. Gas pressure regulators designed and equipped with vent limiting devices need not be vented to the outdoors. Other gas pressure regulators shall be vented directly to the outdoors.

5. Relief valves and normally open vent valves shall be vented directly to the outdoors.

6. Vent line size

7. Vent lines for gas pressure regulators and other devices requiring venting which do not normally discharge gas through the vent shall be vented to the outdoors through a rigid pipe at least 3/4" in size. Consideration shall be given to increasing the size of the vent lines longer than 20 feet. Manifolding of these vents is allowed providing the cross-sectional area of a common vent line is equal to the sum of the cross sectional areas of the manifolded vent lines.

8. Vent lines for relief valves and normally open vent valves shall be piped directly to the outdoors. (They shall not be vented commonly with devices requiring atmospheric air pressure to balance a diaphragm.) The size of these lines shall be calculated to provide full relief capacity under the conditions of design. The size of such lines shall never be less than the size of the connection at the device. Manifolding of these vent lines is allowed providing the cross-sectional area of a common vent line is not less than the cross-sectional area of the largest individual line plus 50% of the total cross-sectional area of all other connecting lines.

9. Vent termination - All vent lines shall terminate outdoors in a safe place and not less than 18" from any opening or overhang. Adequate means shall be employed to prevent water from entering the vent pipe, and also to prevent stoppage of it by insects or foreign matter.

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END OF SECTION 221114

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SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings
2. Ductile iron pipe and fittings
3. Pipe joining materials
4. Specialty valves
5. Transition fittings
6. Dielectric fittings.

B. Related Section:
1. Section 221119 Domestic water Piping specialties.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Piping
3. Transition fittings.
4. Dielectric fittings.
5. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping, storm water piping and sanitary piping.
3. HVAC hydronic piping and Ductwork.
4. Electrical conduits.

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D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, 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.

B. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.

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3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

C. Copper-Tube, Extruded-Tee Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. Elkhart Products Corporation.
   c. Mueller Industries, Inc.
   d. NIBCO INC.

2. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 DUCTILE-IRON SERVICE PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.4 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.

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2.5 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.

2.6 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.7 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. 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. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric 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. Capitol Manufacturing Company.

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b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

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. 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.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. 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. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.

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3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 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. Hot water piping lengths for fixture connections shall comply with New York State Energy Code Table C404.5.1.

C. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

D. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

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 "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install domestic water piping level without pitch and plumb.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. 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.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping adjacent to equipment and specialties to allow service and maintenance.

L. Install piping to permit valve servicing.

M. 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.

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N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 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," "Brazed Joints" Chapter.

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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. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts

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. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 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 2-1/2and 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.

3.4 DIELECTRIC FITTING INSTALLATION

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings or nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

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3.5 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. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 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.

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2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 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.

3.8 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.

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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. Submit for engineers review and approval.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

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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.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, up to NPS 6 and larger, shall be one of the following:
1. Soft copper tube, ASTM B 88, Type K, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.

E. Under-building-slab, combined domestic water, building-service, and or fire-service-main piping, up to NPS 12, shall be the following:
1. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.

F. Aboveground domestic water distribution piping, all sizes shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and joints.

G. Aboveground, combined domestic water-service and fire-service-main piping, all sizes shall be one of the following:
1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

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1. Shutoff Duty: Use ball or gate valves for piping NPS 2and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2and 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.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

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SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. 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. Electronic mixing valves
7. Strainers.
8. Outlet boxes
9. Hose bibbs.
10. Wall hydrants.
11. Drain valves.
12. Water hammer arresters.
13. Air vents.
14. Trap-seal primer valves.
15. Trap seal primer systems
16. Flexible connections

B. Related Sections include the following:
1. Division 221116 Section "Domestic Water Piping".

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Field quality-control test reports.

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C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. 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 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 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:

   a. FEBCO
   b. Zurn Industries, LLC
   c. Watts
   d. Ames Co.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

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B. Hose-Connection 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:

      a. FEBCO
      b. Zurn Industries, LLC
      c. Watts
      d. Ames Co.
   2.
   3. Standard: ASSE 1011.
   4. Body: Bronze, nonremovable, with manual drain.
   5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
   6. Finish: Chrome or nickel plated.

C. Laboratory-Faucet 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:

      a. FEBCO
      b. Zurn Industries, LLC
      c. Watts
      d. Ames Co.
   2.
   3. Standard: ASSE 1035.
   4. Size: NPS 1/4 or NPS 3/8 matching faucet size.
   5. Body: Bronze.
   6. End Connections: Threaded.
   7. Finish: Chrome plated.

2.4 BACKFLOW PREVENTERS

A. Double-Detector Check Backflow-Prevention Assemblies: (fire line)

   1. Ames Co. or a comparable product by one of the following as indicated on Drawings:

      a. FEBCO; SPX Valves & Controls.
      b. Zurn Plumbing Products Group; Wilkins Div.
      c. Watts Industries

   2. Standard: ASSE 1015.
   3. Operation: Continuous-pressure applications, unless otherwise indicated.
   4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
   5. Size, Design Flow Rate: as indicated on drawings.
   6. Body: stainless steel.
   7. End Connections: Flanged.
   8. Configuration: Designed for horizontal, straight through flow.

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9. Accessories:

   a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.

B. Reduced-Pressure-Principle Backflow Preventers: (domestic water service)

1. Ames Co. model as indicated on Drawings, or a comparable product by one of the following as indicated on Drawings:

   a. Watts Industries.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller.
6. End Connections: Threaded for NPS 2 and smaller.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

   a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Beverage-Dispensing-Equipment Backflow Preventers:
1. Ames Co. or a comparable product by one of the following as indicated on Drawings:

   a. FEBCO; SPX Valves & Controls.
   b. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:
1. Ames Co. or a comparable product by one of the following as indicated on Drawings:

   a. FEBCO; SPX Valves & Controls.
   b. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Size: [**NPS 1/2**] [**NPS 3/4**] [**NPS 1**] [**NPS 1-1/4**].
5. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:
1. Ames Co. or a comparable product by one of the following as indicated on Drawings:

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a. FEBCO; SPX Valves & Controls.
b. Zurn Plumbing Products Group; Wilkins Div.

2.
3. Standard: ASSE 1032.
4. Operation: Continuous-pressure applications.
5. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).
6. Body: Stainless steel.
7. End Connections: Threaded.

F. 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:

a. FEBCO; SPX Valves & Controls.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 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:
a. zurn
b. Watts
c. Josam.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:
1. 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:

a. FEBCO
b. Zurn Industries, LLC
c. Watts

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d. Ames Co.

2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

   a. Pattern: Angle or Globe-valve design.
   b. Trim: Stainless steel.

5. Design Flow: as per plan
6. Design Inlet Pressure: as per plan
7. Design Outlet Pressure Setting: as per plan
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 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:

   a. Conbraco Industries, Inc.
   b. Crane Co.; Crane Valve Group
   c. Milwaukee Valve Company.
   d. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. <u>Individual-Fixture</u>, Water Tempering Valves:

1. Lawler Company Model 911, or a comparable product by one of the following:

   a. Armstrong International, Inc.
   b. Leonard Valve Company.

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c. Powers; a Watts Industries Co.
d. Symmons Industries, Inc.

2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psigminimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 80˚F

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:

a. Holby Valve Co., Inc.
b. Lawler Manufacturing Company, Inc.
c. Leonard Valve Company.
d. Powers; a Watts Industries Co.
e. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Tempered-Water Setting: 120˚F
10. Valve Finish: Rough bronze.
11. Piping Finish: Copper

2.8 ELECTRONIC MIXING VALVES

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:

a. Heat timer
b. Powers; a Watts Industries Co.
c. Symons Industries, Inc.

B. Description; electronic hot water temperature control mixing valve with safeguard. With digital controller and LED display
1. Conforms to ASSE 1017, lead free plumbing codes, ANSI 61.
2. Combination temperature control with alarm safeguard

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3. Heating or cooling applications
4. Remote communications
   a. Internet – heat Timer RINET
   b. BACnet IP or MSTP
   c. Modbus
5. Stainless steel 3- way valve body
   a. Max operating temp 300 deg F
   b. Max operating pressure 225 psi
   c. 640 stainless steel stem
6. Accuracy: .5 gpm to full flow +- 1 degree
7. 120v power, 24v actuator
8. Digital display LED output status lights.
9. Function selection buttons
10. Graphic display interface

2.9 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. StrainersNPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.10 OUTLET BOXES;

A. Clothes Washer Outlet Boxes:
1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

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B. Icemaker Outlet Boxes:
   1. Mounting: Recessed.
   2. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
   3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
   4. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.11 HOSE STATIONS

A. Single-Temperature-Water Hose Stations :

   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. ARCHON Industries, Inc.
      b. Armstrong International, Inc.
      c. DynaFluid Ltd.
      d. Leonard Valve Company.
      e. T&S Brass and Bronze Works, Inc.

   2. Standard: ASME A112.18.1.
   3. Cabinet: Stainless steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
   4. Hose-Rack Material: Stainless steel.
   5. Body Material: Bronze with stainless steel wetted parts.
   6. Body Finish: Rough bronze, OR chrome plated.
   7. Mounting: Wall, with reinforcement or Floor, with stainless steel pedestal as per plan
   8. Supply Fittings: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
   9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 25 feet long.
   10. Nozzle: With hand-squeeze, on-off control.
   11. Vacuum Breaker:

      a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
      b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.12 HOSE BIBBS

A. Interior Mechanical Room Application:

   1. Available Manufacturers:
      a. Watts.

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b. Nibco.
c. Chicago.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Include operating key with each operating-key hose bibb.

B. Interior Toilet Room Application:

1. Available Manufacturers:

a. Woodford Manufacturing.
b. Chicago Faucet.

2. Body: Bronze or brass with integral mounting flange.
3. Seat: Bronze, replaceable.
4. Supply Connections: 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, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: chrome or nickel plated.
9. Operation: Wheel handle or operating key.
10. Include operating key with each operating-key hose bibb.

2.13 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze or Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

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10. Nozzle and Wall-Plate Finish: Polished nickel bronze in public area, Rough bronze in utility rooms.
11. Operating Keys(s): One with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze in exposed public area, or Chrome plated.
9. Vacuum Breaker:

a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7 on outlet.

10. Operating Key(s): One with each wall hydrant.

C. Vacuum Breaker Wall Hydrants:

1.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. 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.
5. Pressure Rating: 125 psig.
6. Operation: Loose key or wheel handle.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.14 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.

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9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

D. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.15 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers:
   a. AMTROL, Inc.
   b. Josam Company.
   c. PPP Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
   f. Jay R. Smith.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Stainless steel construction with metal bellows, precharged.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

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2.16 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.17 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. PPP Inc Model P-2 with Distribution Unit DU-2 or a comparable product by one of the following:

   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.18 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
1. Standard: ASSE 1044.
2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
3. Cabinet: Recessed-mounted steel box with stainless-steel cover.
4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

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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.

5. Vacuum Breaker: ASSE 1001.
6. Number Outlets: Four.
7. Size Outlets: NPS 1/2.

2.19 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex Pression Ltd.
2. Flex-Hose Co., Inc.
3. Metraflex Company (The).
4. Universal Metal Hose.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 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.

C. 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 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXCUTION

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 balancing valves in locations where they can easily be adjusted.

C. 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.

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D. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump, and where indicated on Drawings.

E. Install water hammer arresters in water piping according to PDI-WH 201.

F. Install air vents at high points of water piping.

G. 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.

H. 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.

I. All valves, fittings and specialties shall have a pressure class rating that exceeds the pressure of the system it is installed in.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.

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7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
8. Double-check, detector-assembly backflow preventers.
9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water mixing-valve assemblies.
13. Photographic-process, thermostatic, water mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer backflow preventer 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.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.
2. Horizontally mounted, in-line, separately coupled centrifugal pumps.
3. Horizontally mounted, in-line, close-coupled centrifugal pumps.
4. Vertically mounted, in-line, close-coupled centrifugal pumps.

B. Related Requirements:

1. Section 221116 "Domestic water piping" for booster systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which pumps will be attached.
2. Size and location of initial access modules for acoustical tile.

B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

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2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 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. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong
2. Bell and Gosset
3. Grundfos Pumps Corp.
4. TACO Comfort Solutions, Inc.

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C. Capacities and Characteristics:

1. Capacity: Refer to plans and schedules

D. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Minimum Working Pressure: 125 psig.
3. Maximum Continuous Operating Temperature: 220 deg F.
4. Casing: Bronze or Stainless steel, with threaded or companion-flange connections.
5. Impeller: composite or stainless steel.
6. Motor: Single

2.3 HORIZONTALLY MOUNTED, IN-LINE, SEPARATELY COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bell & Gossett; a Xylem brand.
2. TACO Comfort Solutions, Inc.
3. Thrush Co. Inc.
4. Armstrong

C. Capacities and Characteristics:

1. Capacity: Refer to plans and schedules.

D. Pump Construction:

1. Casing:

a. Radially split bronze or stainless steel with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
c. Gauge port tappings at suction and discharge nozzles.

2. Impeller: Bronze or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.

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3. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
6. Bearings: Grease-lubricated or permanently lubricated ball type.
7. Minimum Working Pressure: 125 psig.
8. Continuous Operating Temperature: 200 deg F.

E. Motor: Single speed, with permanently lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

2.4 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bell & Gossett; a Xylem brand.
2. TACO Comfort Solutions, Inc.
3. Thrush Co. Inc.
4. Armstrong

C. Capacities and Characteristics:

1. Capacity: Refer to plans and schedules

D. Pump Construction:

1. Casing:

a. Radially split bronze or brass with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
c. Gauge port tappings at suction and discharge nozzles.

2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

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5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
6. Bearings: Grease-lubricated or permanently lubricated ball type.
7. Minimum Working Pressure: 175 psig.
8. Continuous Operating Temperature: 225 deg F.

E. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.

2.5 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Bell & Gossett; a Xylem brand.
3. PACO Pumps; Grundfos Pumps Corporation, USA.
4. TACO Comfort Solutions, Inc.

C. Capacities and Characteristics:

1. Capacity: Refer to plans and schedules.

D. Pump Construction:

1. Casing: Radially split bronze, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
2. Impeller: Bronze, brass or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: stainless-steel shaft, with copper-alloy shaft sleeve.
4. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
6. Bearings: Oil-lubricated; bronze-journal or ball type.
7. Minimum Working Pressure: 175 psig.
8. Continuous Operating Temperature: 225 deg F.

E. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.

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2.6 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.7 CONTROLS

A. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 24 V ac or.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Pump Mounting:

1. Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using vibration isolation type and deflection as specified in Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

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D. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
   1. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

E. Install pressure switches in water-supply piping.

F. Install thermostats in hot-water return piping.

G. Install timers on wall in engineer's office, MER room where hot water heaters are located or as directed.

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

   1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

      a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
      b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
      c. Vertically mounted, in-line, close-coupled centrifugal pumps.
      d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:

   1. Section 220523. "General Duty Valves for Plumbing Piping."
   2. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

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3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats, timers, for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

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a. Verify bearing lubrication.
b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.8 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123.21

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SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Requirements:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
1. Gravity Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

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

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 300-foot head of water
2. Waste, Force-Main Piping: 100 psig.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. MIFAB, Inc.
d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

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C. Heavy-Duty, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. ANACO-Husky.
      b. Dallas Specialty & Mfg. Co.
      c. MIFAB, Inc.
      d. Tyler Pipe.

   2. Standards: ASTM C 1277 and ASTM C 1540.
   3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. ANACO-Husky.
      b. Dallas Specialty & Mfg. Co.
      c. MIFAB, Inc.
      d. Tyler Pipe.

   2. Standard: ASTM C 1277.
   3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. No Hub Fitting Restraints;
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Holdrite: 117 Series No Hub Fitting Restraints or comparable

   2. Description: CISPI Designation 301-12, large diameter no-hub cast iron fittings, 4" and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution.

2.4 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153/A21.53, ductile iron, for push-on joints.

D. Gaskets: AWWA C111/A21.11, rubber.

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2.5 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Mechanical-Joint Piping:

1. Pipe: AWWA C151/A21.51, with bolt holes in bell.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, with bolt holes in bell.
3. Compact Fittings: AWWA C153/A21.53, with bolt holes in bells.
4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe, fittings, and glands

2.6 PRESSURE-TYPE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cascade Waterworks Mfg. Co.
2. Dresser, Inc.
3. Jay R. Smith Mfg. Co.
4. JCM Industries, Inc.
5. Victaulic Company.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.

D. Center-Sleeve Material: Stainless steel or Ductile iron.

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material

2.7 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

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1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.8 SPECIALTY PIPE FITTINGS

A. Non-pressure Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

   a. Standard: ASTM C 1173.
   b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. Sleeve Materials:
      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Concrete Pipes: ASTM C 443, rubber.
      3) For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      4) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      5) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Ring-Type, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

C. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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) Capitol Manufacturing Company.
2) Hart Industries International, Inc.
3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
4) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Nipples:

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) Grinnell Mechanical Products.
2) Precision Plumbing Products, Inc.
3) Victaulic Company.

b. Description:

1) Electroplated steel nipple complying with ASTM F 1545.
2) Pressure Rating: 300 psig at 225 deg F.
3) End Connections: Male threaded or grooved.
4) Lining: Inert and noncorrosive, propylene.

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2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. EBAA Iron, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products.

2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dresser, Inc.
   b. EBAA Iron, Inc.
   c. JCM Industries, Inc.
   d. Smith-Blair, Inc.; a Sensus company.

2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psigminimum working pressure and for up to 15 degrees of deflection.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.

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c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

3. Horizontal type; with swing check valve and hub-and-spigot ends.
4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
5. Terminal type; with bronze seat, swing check valve, and hub inlet.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Watts Water Technologies, Inc.
d. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

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G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. 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 two 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.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.

3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

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Q. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

R. Install force mains at elevations indicated

S. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

3. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 PIPE JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. 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.

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C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Shielded flexiblecouplings for pipes of same or slightly different OD.
b. Unshielded, increaser/reducer-pattern, flexiblecouplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105/A21.5:
1. Hubless cast-iron soil pipe and fittings.
2. Ductile-iron pipe and fittings.
3. Expansion joints and deflection fittings.

H. Install No Hub Fitting Restraints on all piping 4 inch and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads. H-50

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B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches Insert dimensions deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523. General-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

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1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting**,** valve, and coupling.

C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8 : 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

E. Install supports for vertical cast-iron soil piping every 15 feet and or at every floor

F. 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 4 and NPS 5: 12 feet with 5/8-inch rod.
8. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
9. NPS 10 and NPS 12 : 12 feet with 7/8-inchrod

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

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3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod

H. Install supports for vertical copper tubing every 10 feet and at every floor

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

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3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

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1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

   a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

   a. Isolate test source and allow to stand for four hours.
   b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect 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.

3.11 PIPING SCHEDULE

A. Aboveground, soil, waste and vent piping all sizes, shall be one of the following:

1. *Service class*, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

B. Underground, soil, waste, and vent piping shall be any of the following:

1. *Extra heavy class*, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, pressure transition couplings.

C. Aboveground and below ground sanitary-sewage force mains up to NPS 3 shall be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

D. **Aboveground and below ground sanitary-sewage force mains over NPS 4 and over shall be the following**:

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1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Fitting-type pressure transition coupling if dissimilar pipe materials.

END OF SECTION 221316

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SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves
   2. Cleanouts.
   3. Air admittance Valves
   4. Floor drains
   5. Pipe Roof flashing assemblies.
   6. Through-penetration firestop assemblies.
   7. Miscellaneous sanitary drainage piping specialties.
   8. Flashing Materials
   9. Protective shielding guards

B. Related Sections include the following:

   1. Division 221316 Section "Sanitary Waste and Vent Piping”.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
   1. Grease interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

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1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.2 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.

2. Standard: ASME A112.14.1.

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3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Zurn Industries, LLC.

2. Size: Same as floor drain outlet.

3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.3 CLEANOUTS

A. Cast Iron Exposed Cleanouts:

1. Available Manufacturers:

   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.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast Iron Exposed Floor Cleanouts:

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1. Available Manufacturers:

   a. Josam Company; Josam Div.
   b. Watts Drainage Products Inc.
   c. Zurn Plumbing Products Group; Light Commercial Operation.
   d. Wade
   e. Jay R. Smith.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Available Manufacturers:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.
   e. Wade
   f. Jay R. Smith

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

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2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ayrlett, LLC.
   b. Durgo, Inc.
   c. Oatey.
   d. ProSet Systems Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.

3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ayrlett, LLC.
   b. Durgo, Inc.
   c. Oatey.
   d. ProSet Systems Inc.

2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

C. Wall Box for Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ayrlett, LLC.
   b. Durgo, Inc.
   c. Oatey.
   d. ProSet Systems Inc.

2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
3. Size: About 9 inches wide by 8 inches high by 4 inches deep

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2.5 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Available manufacturers:
   a. Josam Company; Josam Div.
   b. Tyler Pipe; Wade Div.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Light Commercial Operation.
   e. Jay R. Smith

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Sediment Bucket: Not required for finished areas.
8. Top or Strainer Material: Nickel bronze.
9. Top Shape: Round.
10. Top Loading Classification: Light Duty.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

2.6 PIPE ROOF FLASHING ASSEMBLIES (all architectural specifications shall supersede this paragraph).

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:

   a. Oatley
   b. Master flash
   c. Portals Plus
   d. Elmdor/Stoneman

2. Description: Manufactured assembly flashing collar with skirt extending at least 8 inches from pipe, for multiple or single pipes.
3. Residential;
   a. Rubber collar
   b. 90 degree or angle to match roof pitch
   c. Temperature range to 212 F
   d. 8”x8” aluminum or stainless steel flashing skirt
4. Commercial;
   a. Flashing assemblies are seamless lead flashings provide for watertight installation using sheet lead complying with ASTM B-29 and Federal Specification QQL-20F, Grade C.

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b. Cast iron counterflashing attach directly to the roof penetration with set screws. Annular space between flashing and counterflashing skirt is to be field sealed using GE Type II silicone caulk or equal
c. Provide, on each roof penetration, lead flashing/counter-flashing assembly. Flashing shall be 4 lbs. seamless lead with 8" skirt and steel reinforced boot and shall permit installation on roofs with up to a 20 degree pitch. Counterflashing shall be cast iron set screw type and be attached directly to the roof penetration. All flashings shall be installed in accordance with manufacturers recommendations and flashed in accordance with the recommendations of the roofing material manufacturer.
d. Provide vandal proof vent cap where required.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.8 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.

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.

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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 2 inches 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: Counter-flashing-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.
3. Low-Silhouette Vent Cap: With vandal-proof vent cap.
4. Extended Vent Cap: With field-installed, vandal-proof vent cap.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.

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3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

J. Automatic Trap Seal Primer Valve:
1. Manufactures;
   a. J. R. Smith
   b. Sioux Chief
   c. Josum
2. Minimum ½ " outlet size to trap.
3. Cast bronze body
4. Sweat or NPT threaded fittings.

2.9 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

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. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
   b. McGuire Manufacturing.
   c. Truebro; a brand of IPS Corporation.
   d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

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2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

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. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

C. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.11 OIL/WATER SEPARATORS

A. Oil/Water Separator:
1. 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. Zurn Plumbing Products Group; Specification Drainage Operation.
b. Josam Company; Josam Div.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

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.

1. 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.

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3. Locate at minimum intervals of 50 feetfor piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

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 through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

K. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

L. 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.

M. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.

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N. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

O. Install vent caps on each vent pipe passing through roof.

P. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Q. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install wood-blocking reinforcement for wall-mounting-type specialties.

S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

T. All valves, fittings and specialties shall have a pressure class rating that exceeds the pressure of the system it is installed in.

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.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

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.
2. Copper Sheets: Solder joints of copper sheets.

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.

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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.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Intercepters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 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.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221319.13 SANITARY DRAINS

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. Cast iron floor drains.
2. Stainless steel floor drains
3. Cast iron floor sinks
4. Stainless steel floor sinks
5. Trench drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

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B. Comply with NSF 14 for plastic sanitary piping specialty components.

C. All sanitary floor drains shall be provided with pro-vent trap guard size for each floor drain. Product shall be tested in accordance with ASSE 1072 test standard for ANSI/ASME A112.6.3

D. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom or Side coordinate with filed conditions.
9. Backwater Valve: Not required unless indicated on drawings.
10. Coating on Interior and Exposed Exterior Surfaces: **For laboratory applications Acid-resistant enamel.**
11. Sediment Bucket:
12. Top grate and Strainer Material: **Gray cast iron in mechanical equipment rooms, polished nickel bronze in all finished areas.**
13. Top Shape: Round or Square as scheduled
14. Dimensions of Top or Strainer: Refer to schedule.
15. Top Loading Classification: **Heavy Duty 20 for any application subject to traffic like parking or repair garages.**
16. Funnel: Not required unless specified on plan or in schedule.
17. Inlet Fitting: **Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.**
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Cleanout, Trap-seal primer valve drain connection where indicated in schedule.

E. Stainless-Steel Floor Drains, ASME A112.3.1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Zurn Industries, LLC.

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2. Outlet: Bottom or Side.

3. Top or Strainer Material: Stainless steel.
4. Top Shape: Round or Square.
5. Dimensions of Top or Strainer:
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Trap-Primer Connection: **Required where indicated on plan**
10. Trap Material: Stainless steel.
11. Trap Pattern: Standard P-trap.

2.2 FLOOR SINKS

A. Cast-Iron Floor Sinks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Zurn Industries, LLC.

3. Standard: ASME A112.6.7.
4. Pattern: Funnel floor drain.
5. Body Material: Cast iron.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom, no-hub connection.
9. Coating on Interior Surfaces: Not required
10. Sediment Bucket: .
11. Internal Strainer: Flat.
12. Internal Strainer Material: Aluminum.
13. Top Grate Material: loose,r hinged.
14. Top of Body and Grate Finish: Nickel bronze.
15. Top Shape: Round or Square.
16. Dimensions of Top Grate: as per plan.
17. Top Loading Classification: .
18. Funnel: Required..

B. Stainless-Steel Floor Sinks, ASME A112.6.7:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Zurn Industries, LLC.

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3. Standard: ASME A112.6.7.
4. Pattern: Funnel floor drain.
5. Body Material: Stainless steel.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom, no-hub connection.
9. Sediment Bucket: .
10. Internal Strainer: Dome or Flat.
11. Internal Strainer Material: Stainless steel.
12. Top Grate Material: loose or hinged.
13. Top of Body and Grate Finish: Satin nickel or Stainless steel.
14. Top Shape: Round or Square.
15. Dimensions of Top Grate: refer to plan and schedule.
16. Top Loading Classification: No traffic.
17. Funnel: Required..

2.3 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. Watts; a Watts Water Technologies company.
   f. Zurn Industries, LLC.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchor and Seepage.
5. Clamping Device: Required.
6. Outlet: Bottom, End or Side coordinate with field conditions
7. Grate Material: Stainless steel.
8. Grate Finish: Brushed.
9. Dimensions of Frame and Grate: refer to plan and schedule
10. Top Loading Classification: Extra Heavy Duty. H-20
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. 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.
3. 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.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

   a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.

1. Install on support devices, so that top will be flush with adjacent surface.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

F. Install open drain fittings with top of hub 2 inches above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

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B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 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.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

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SECTION 22 14 29 SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submersible sump pumps.
2. Sump-pump basin covers.
3. Elevator Oil Minder Sump Pump.

B. Related Section:

1.3 SUBMITTALS

A. Product Data: For each type of pump, motor, control panel, basin cover. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

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C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Federal Pumps
    b. Bell & Gossett Domestic Pump; ITT Corporation.
    c. Goulds Pumps; ITT Corporation.
    d. Grundfos Pumps Corp.
    e. Liberty Pumps.
    f. Stancor, Inc.

2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Seal: Mechanical.
6. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
7. A name-plate showing the serial number, discharge GPM and Head of each pump shall be attached to the respective pump. The necessary wiring and controlling devices will be furnished and installed complete under the Electrical Division, unless otherwise specified.
8. Controls:

    a. Duplex Sump pump shall be controlled by a pedestal mounted float switch with built in alternator, Square D Company Class 9038 type AW-1 in a NEMA Type 4 watertight and dust-tight enclosure that is actuated by a minimum 7" stainless steel ball float and stainless steel rod guided above and below floor plate of pump.
    b. Provide a high water alarm consisting of an auxiliary pedestal mounted single pole float switch equipped with a pedestal guide, gas-tight stainless steel rod and minimum 7" stainless steel ball float. Should the high water alarm be activated, a warning signal shall be delivered to the Indicator Panel. With electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
    c. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.

9. Control-Interface Features:

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a. Remote Alarm Contacts: For remote alarm interface.
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

2.2 SUMP PUMP CAPACITIES AND CHARACTERISTICS

1. Refer to Drawing P-001 for unit specifications and capacities.

2.3 SUMP-PUMP BASIN COVERS

A. Angle frame and sump pit cover plate shall be provided and installed by the Plumbing Contractor. The Contractor shall coordinate the sump pit cover with the pump supplier such that it has all required openings for pumps and piping with openings having gaskets, seals, and bushings such as: access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic.

2.4 SUMP PUMP (ELEVATOR PIT)

A. Provide a Stancor pump in the elevator pit. Refer to Drawing P-001 for pump specifications and capacities.

B. Provide check valve on pump discharge. Provide 5 ft. extra cable rolled and clamped to allow for removal of pump from pit. Provide a local disconnect switch, and pump control panel where indicated on the drawings.

C. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

D. Seal: Mechanical.

E. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

F. A name-plate showing the serial number, discharge GPM and Head of each pump shall be attached to the respective pump. The necessary wiring devices will be furnished and installed complete under the Electrical Division, unless otherwise specified.

G. Controls:
1. Simplex sump pump shall be controlled by a pedestal mounted float switch that is actuated by a minimum 7" stainless steel ball float and stainless steel rod guided above and below floor plate of pump. Or a cable mounted floats for on off.

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2. Provide a high water alarm consisting of an auxiliary pedestal mounted single pole float switch, equipped with a pedestal guide, (or cable mounted float) gas-tight stainless steel rod and minimum 7" stainless steel ball float. Should the high water alarm be activated, a warning signal shall be delivered to the Indicator Panel. With electric bell; 120-V ac, with transformer and contacts for remote alarm bell. The contacts shall be wired to the building BMS. Upon contact closure an alarm signal shall be initiated on the BMS which indicates high water and which elevator pit is being served. (ie. Main elevator bank or side walk lift elevator)

3. Switch Type: float switch with float rods and rod buttons. Or cable mounted.
4. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
5. Control Panel CB 1000;
   a. Pumps serving non hydraulic elevators shall have pump control panels that are NEMA 4x suitable for pump control with optional dry remote alarm contacts for high water alarm.
   b. Stanmore model CB 1000. With pump running light, high level alarm, test and silence bottom and H-O-A selector switch.
   c. Pumps serving hydrolic elevators shall have a Nema 4x control panel 4x suitable for pump control with (2) optional dry remote alarm contacts for high water alarm and oil alarm. Provide stainless steel discriminating oil detector.
   d. Panel and pump system shall be Stancore oil minder model OM-50SR- ELV , with reset button, silence button RMS connector.
   e. Provide local disconnect switch for all pump systems.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Division 31 Section "Earth Moving."

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3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

B. The Contractor shall have the pump supplier verify the depth of each sump pit so that proper length of shaft shall be supplied.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make all required connections of pumps to the piping systems. Use flexible connectors to connect pumps to piping.

C. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

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3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

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SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems:

1. Pipes, tubes, and fittings.
2. Joining materials.
3. Valves.
4. Dielectric fittings.
5. Flexible pipe connectors.
6. Specialties.
7. Quick couplings.
8. Hose assemblies.

B. Related Sections include the following:

1. Section 221519 "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. HDPE: High-density polyethylene plastic.

E. NBR: Acrylonitrile-butadiene rubber.

F. PE: Polyethylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.

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I. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Dielectric fittings.
   2. Flexible pipe connectors.
   3. Safety valves.
   4. Pressure regulators. Include rated capacities and operating characteristics.
   5. Automatic drain valves.
   6. Filters. Include rated capacities and operating characteristics.
   7. Lubricators. Include rated capacities and operating characteristics.
   8. Quick couplings.
   9. Hose assemblies.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Qualification Data: For installers.

C. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

   1. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by T-DRILL Industries Inc., for making branch outlets.
   2. Joining Procedures for Aluminum Piping Systems: Qualify installers according to training provided by manufacturers.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. ASME Compliance:

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1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
2. Comply with ASME B31.3, "Process Piping," for high- and low-pressure compressed-air piping.
3. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.

1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
7. Grooved-End Fittings and Couplings:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Anvil International.
      2) Grinnell G-Fire by Johnson Controls Company.
      3) Star Pipe Products.

8. Couplings: AWWA C606 or UL 213, for steel-pipe dimensions and rated for 300-psig minimum working pressure. Include ferrous housing sections, gasket suitable for compressed air, and bolts and nuts. Provide EDPM gaskets for oil-free compressed air. Provide NBR gaskets if compressed air contains oil or oil vapor.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

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B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 VALVES

A. Metal Ball, Check, and Comply with requirements in Section 220523. "general Duty Valves for Plumbing Piping,"

2.4 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.
2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 300 psig.
   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. Matco-Norca.
   b. Viega LLC.
   c. WATTS.
   d. Wilkins.

2. Description:

   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 300 psig.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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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: 250 psig.
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.

2.5 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Flex-Hose Co., Inc.
   2. Metraflex Company (The).
   3. Proco Products, Inc.
   4. Unaflex.
   5. Universal Metal Hose.

B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

   1. Working-Pressure Rating: 250 psig minimum.
   2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
   3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.6 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

   1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.

   1. Type: Pilot operated.

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C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

G. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.

1. Provide with automatic feed device for supplying oil to lubricator.

2.7 QUICK COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation.
2. Foster Manufacturing, Inc.
3. Milton Industries, Inc.
4. TOMCO Products Inc.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Flow-sensor-bleeder, check-valve type with barbed outlet for attaching hose.

D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.

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2. Plug End: With barbed outlet for attaching hose.

2.8 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.

1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless-steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:

1. NPS 2 and Smaller: Schedule 10, black-steel or galvanized steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2-1/2 to NPS 4: Schedule 40, black or galvanized-steel pipe; threaded, malleable-iron fittings; and threaded joints.

B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Schedule 10, black or galvanized-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2-1/2 to NPS 4: Schedule 40, black or galvanized-steel pipe; threaded, malleable-iron fittings; and threaded joints.

C. High-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:

1. NPS 2 Insert pipe size and Smaller: Schedule 40, black or galvanized-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2-1/2 to NPS 6: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.

D. Drain Piping: Use the following piping materials:

1. and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

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3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Articles in Section 220523. "General Duty Valves for Plumbing Piping," according to the following:

1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. High-Pressure Compressed Air: Valve types specified for medium-pressure compressed air.
3. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Flanged joints may be used instead of specified joint for any piping or tubing system.

J. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, according to Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.

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K. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

L. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

M. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 " and Gages for Plumbing Piping."

N. Install piping to permit valve servicing.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

T. All piping and fitting shall be painted black.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. 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.

D. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.

E. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

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F. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B828 or CDA's "Copper Tube Handbook."

G. Extruded-Tee Outlets for Copper Tubing: Form branches according to ASTM F2014, with tools recommended by procedure manufacturer, and using operators qualified according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

I. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Section 220523.

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. NPS 2 and Smaller: Use dielectric unions.

C. NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

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B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment and tools.

D. Install automatic drain valves on after-coolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall.

F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.

G. Install air-line lubricators in branch piping to machine tools.

H. Install quick couplings at piping terminals for hose connections.

I. Install hose assemblies at hose connections.

3.9 CONNECTIONS

A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

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H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

I. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
3. NPS 1-1/2: 12 feet with 3/8-inch rod.
4. NPS 2: 13 feet with 3/8-inch rod.
5. NPS 2-1/2: 14 feet with 1/2-inch rod.
6. NPS 3: 15 feet with 1/2-inch rod.
7. NPS 3-1/2: 16 feet with 1/2-inch rod.
8. NPS 4: 17 feet with 5/8-inch rod.
9. NPS 5: 19 feet with 5/8-inch rod.
10. NPS 6: 21 feet with 3/4-inch rod.
11. NPS 8: 24 feet with 3/4-inch rod.
12. NPS 10: 26 feet with 7/8-inch rod.
13. NPS 12: 30 feet with 7/8-inch rod.

J. Install supports for vertical, Schedule 40, steel piping every 15 feet.

K. Install hangers for Schedule 5, steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/2: 72 inches with 3/8-inch rod.
2. NPS 3/4: 84 inches with 3/8-inch rod.
3. NPS 1: 96 inches with 3/8-inch rod.
4. NPS 1-1/4: 108 inches with 3/8-inch rod.
5. NPS 1-1/2: 10 feet with 3/8-inch rod.
6. NPS 2: 11 feet with 3/8-inch rod.

L. Install supports for vertical, Schedule 5, steel piping every 10 feet.

M. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.
12. NPS 5: 18 feet with 1/2-inch rod.
13. NPS 6: 20 feet with 5/8-inch rod.

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14. NPS 8: 23 feet with 3/4-inch rod.

N. Install supports for vertical copper tubing every 10 feet.

O. Use manufacturer's recommended hangers and supports for aluminum piping system.

1. Description: Wire rope using adjustable camlock system with standard threaded stud for connection to provided hangers.
2. Hangers: UV-stabilized nylon and galvanized clevis style.
3. Install hangers for aluminum piping every 8 feet
4. Install supports for vertical aluminum piping every 8 feet.

P. Install supports for vertical HDPE piping every 48 inches.

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters lubricators and pressure regulators for proper operation.

C. Prepare test reports.

END OF SECTION 221513

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SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Gas fired Domestic- Water Heaters and storage heaters:

1) Storage Tank: 10 years.
2) Controls and Other Components: Two year(s).

3) Heat Exchanger: Five years.
4) Separate Hot-Water Storage Tanks: 10 years.

b. Gas-Fired, Tankless, Domestic-Water Heaters:

1) Heat Exchanger: Five years.
2) Controls and Other Components: Three years.

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c. Commercial, Gas- and Oil-Fired, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Burner: Two year(s).
3) Controls and Other Components: Three years.

d. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A. O. Smith Corporation.
b. Bradford White Corporation.
c. PVI; A WATTS Brand.
d. Rheem Manufacturing Company.
e. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 94% percent combustion efficiency at optimum operating conditions and shall be direct vent.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Lining: Cement, Glass, Nickel plate, Phenolic coating, or Sheet copper complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

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c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, direct vent domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics: refer to plans and schedules

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A. O. Smith Corporation.
b. AMTROL, Inc.
c. Honeywell.
d. Pentair Pump Group.
e. State Industries.
f. TACO Comfort Solutions, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: as specified on plan but not let then 5 gallon minimum.

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c. Air Precharge Pressure: 15.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and memory-stop balancing valves to provide balanced flow through each domestic-water heater.

F. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "General Duty Valves for Plumbing Piping," .

1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

H. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

I. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

J. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

K. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

M. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

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N. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on concrete housekeeping pad.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

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5. Anchor domestic-water heaters to substrate.

C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

D. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 General Duty Valves for Plumbing Piping. Install gas-fired, domestic-water heaters according to NFPA 54.

2. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
3. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
4. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

E. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 “Natural-Gas Piping."

F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

I. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

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J. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 General Duty Valves for Plumbing Piping.

K. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill domestic-water heaters with water.

M. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Section 231123 “ Natural-Gas Piping."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and re-inspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

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

END OF SECTION 223400

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SECTION 224213.13 - COMMERCIAL WATER CLOSETS

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. Floor-mounted, bottom-outlet water closets.
2. Wall-mounted water closets.- Back outlet.
3. Flushometer valves.
4. Toilet seats.
5. Supports.

B. Related Requirements:

1. Section 221316 "Sanitary waste and vent piping
2. Section 221319 "sanitary waste piping specialties.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

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 for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

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1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS **(P-1) Not Used**

A. Water Closets, Floor Mounted, Bottom Outlet. Basis of design American standard Madera Flo wise toilet with Selectronic flush valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard.
b. Crane Plumbing, L.L.C.
c. Kohler Co.
d. Sloan Valve Company.
e. Zurn Industries, LLC.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet or reverse trap.
d. Style: Flushometer valve.
e. Height: 16 1./2” rim height
f. Rim Contour: Modified elongated or regular.
g. Water Consumption: 1.1 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; back.
i. Color: White.
j. Operating pressure; 25 psi

3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.
4. Flushometer Valve: model 6065.11 ADA compliant, hands free. Selectronic
a. Factory-Installed CR-P2 Lithium Battery
b. Self-Cleaning Piston with integral wiper spring significantly reduces clogging and maintenance

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c. Selectronic® Proximity System with universal sensor provides hygienic, "hands free" operation
d. Dezincification Resistant semi-red brass alloy
e. Fully Mechanical Manual Override Button can flush the valve without power
f. Fail-Safe: Valve automatically closes upon loss of power or water pressure and does not need to be reset
g. Adjustable Sanitary Flush cleans the fixture & maintains the trap seal.
h. Chemical Resistant EPDM Seals for extended life
i. Adjustable Tailpiece for rough-in flexibility
j. Can be installed left or right-handed
k. 1" IPS angle stop with back flow protection and vandal cap
l. 1 ½" high pressure vacuum breaker.

5. Toilet Seat: IAPMO/ANSI Z124.5, Type A (residential), Shape 3 (elongated rim), open front, without cover, and shaped to match bowl.

2.2 WALL-MOUNTED WATER CLOSETS

A. Water Closets, Wall Mounted, Top Spud, Accessible **P-1:** Basis of design American standard AFWALL Flo wise toilet with Selectronic flush valve

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard.
b. Crane Plumbing, L.L.C.
c. Kohler Co.
d. Sloan Valve Company.
e. Zurn Industries, LLC.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.
i. Model 2257.101
j. Operating pressure; 25 psi

3. Flushometer Valve: model 6065.111, ADA compliant.
4. Flushometer Valve: model 6065.11 ADA compliant, hands free. Selectronic
a. Factory-Installed CR-P2 Lithium Battery
b. Self-Cleaning Piston with integral wiper spring significantly reduces clogging and maintenance
c. Selectronic® Proximity System with universal sensor provides hygienic, "hands free" operation
d. Dezincification Resistant semi-red brass alloy

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e. Fully Mechanical Manual Override Button can flush the valve without power
f. Fail-Safe: Valve automatically closes upon loss of power or water pressure and does not need to be reset
g. Adjustable Sanitary Flush cleans the fixture & maintains the trap seal.
h. Chemical Resistant EPDM Seals for extended life
i. Adjustable Tailpiece for rough-in flexibility
j. Can be installed left or right-handed
k. 1" IPS angle stop with back flow protection and vandal cap
l. 1 ½" high pressure vacuum breaker.

5. Toilet Seat: split front - oval
6. Support: Water closet carrier.
7. Water-Closet Mounting Height: Standard height 15" and Handicapped/elderly according to ICC/ANSI A117.1. where indicated on architectural plans.

2.3 TOILET SEATS

A. Toilet Seats **P-1:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard.
   b. Church Seats; Bemis Manufacturing Company.
   c. Kohler Co.
   d. Zurn Industries, LLC.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company.
   b. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching

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fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

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1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

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SECTION 22 42 13.16 COMMERCIAL URINALS

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. Wall-hung urinals.
   2. Urinal flushometer valves.
   3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

   1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
   2. Waterless Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
   3. Waterless Urinal Trap-Seal Liquid: Equal to 1 gal. for each urinal installed.

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PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS **(P-4)**

A. Urinals, Square Wall Hung, Back Outlet, Washout

B. Basis of design: American Standard Washbrook, Flowise High efficiency Urinal model 6590.001 with Selectronic Flush valve model 606B.051

C. Manufacturers: Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:

a. American Standard.
b. Kohler Co.
c. Zurn Industries, LLC.

1. Fixture: American Standard Allbrook, Flowise High efficiency Urinal model 6550.510
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Washout with extended shields.
   d. Strainer or Trapway: with integral trap.
   e. Water Consumption: .5 gpf - 1.0 gpf
   f. Inlet spud Size and Location: NPS 3/4, top.
   g. Outlet Size and Location: NPS 2, back.
   h. Flushing rim
   i. Elongated 14" rim from finished wall
   j. Siphon Jet flush action
   k. Meets ANSI flush requirements at 0.5 to 1.0 gpf
   l. Model 6550.001 top spud
   m. Color: White.
   n. Mounting height up to 24÷. 17÷ where ADA required.

2. Flushometer Valve: Selectronic flush valve 606B.051
   a. PK00.HAC Hard-wired AC transformer, 10ù extension cable and capacitor module
   b. Exclusive Pressure Compensation feature eliminates the need for the installer to adjust the stop valves, saving time and money and ensuring water savings for öHands Free÷ operation
   c. Self-Cleaning Piston operation with integral wiper spring prevents clogging and reduces maintenance repeatability
   d. Adjustable tailpiece
   e. Chemical resistant EPDM seals are unaffected by chloramines and ammonia
   f. Valve remains closed and does not need to be reset after loss of power or water pressure
   g. Stadium Feature: Valve automatically switches to water conservation mode during periods of heavy usage
   h. Fully Mechanical Manual Override Button can flush toilet during a power outage
   i. Vandal-resistant metal cover plate (for 2-gang electric box supplied by others) with no visible fasteners
   j. Sensor & electronic controls are fully enclosed and water resistant

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k. Range can be adjusted manually or by remote control
l. Sanitary Flush - Valve automatically flushes after 24 hours of non-use to clean fixture & maintain trap seal
m. No external volume adjustment
n. 5 second Arming Delay prevents unintentional flushing
o. 3-second Flush Delay
p. Can be installed left or right-handed
q. Operating pressure: 20 psi (flowing) ô 80 psi (static)
r. Flow requirement: 10 gpm

3. Waste Fitting:
   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2.

4. Support: Zurn model Z1221 Wall urinal support system with top support plate. Complete with Dura-Coated rectangular steel uprights with welded feet, adjustable support plate, and mounting fasteners.

5. Urinal Mounting Height: Standard and Handicapped/elderly according to ICC A117.1. refer to architectural plans for locations and heights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.

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3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

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3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

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SECTION 22 42 16 - COMMERCIAL LAVATORIES AND FAUCETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Vitreous China wall hung Lavatory
2. Faucets
3. Shields and Guards

1.2 RELATED SECTIONS

1. 221116 "Domestic Water Piping Specialties"
2. 221119 "Domestic Water Piping Specialties"

1.3 REFERENCES

A. American Society of Sanitary Engineering (ASSE):

1. ASSE 1070 - Water Temperature Limiting Devices.

B. American Society of Mechanical Engineers (ASME):

1. ASME A112.18.1 - Plumbing Fixture Fittings.

C. ASTM International (ASTM):

1. ASTM C 170 - Standard Test Method for Compressive Strength of Dimension Stone.
2. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
3. ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. International Code Council (ICC):

1. ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities.

E. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code.

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F. Underwriters Laboratories, Inc. (UL):

1. UL 723 - Test For Surface Burning Characteristics of Building Materials.

2. UL 1951 - Electric Plumbing Accessories.

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 for lavatories.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.5 INFORMATION SUBMITTALS

A. Sample warranty.

B. Manufacturer's certificates.

C. Indoor environmental quality certificates.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    a. Servicing and adjustments of automatic faucets.

1.7 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of plumbing fixtures. Manufacturers seeking approval must submit the following:

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1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.

2. Samples of each component of product specified.

3. List of successful installations of similar products available for evaluation by Architect.

4. Submit substitution request not less than 15 days prior to bid date.

B. Source Limitations: Obtain each type of plumbing fixture and compatible accessories through one source from a single approved manufacturer.

C. Accessibility Requirements: Comply with requirements of ADA/ABA and with requirements of authorities having jurisdiction.

D. Water Flow and Consumption Requirements: Comply with EPACT.

E. Drinking Water Standard: Certified to NSF/ANSI 372.

F. Electrical Components: Listed and labeled per NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Indoor Environmental Quality Certification: Provide certificate indicated that products have been certified under the following programs, or a comparable certification acceptable to Owner:

1.9 WARRANTY

A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship within the prescribed time periods:

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES **(P-2)**

A. Basis of design: American Standard, Aqualyn, Counter Sink

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
   a. American Standard.
   b. Kohler Co.
   c. Zurn Industries, LLC.
   d. Sloan Valve Company

C. Fixture:
   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Type: For top of counter mounting.
   c. Nominal Size: Oval, **16" x 10" x5 5/8"**
   d. Faucet-Hole Punching: 3 hole
   e. Faucet-Hole Location: 4" center

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f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.
h. 1 ¼" tail piece

2. Compliance; ASME A112.19.2 M for vitreous chine fixtures. ANSI 117.1 for accessibility.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES **(P-3)**

A. Basis of design: American Standard, Murro Universal Design

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
a. American Standard.
b. Kohler Co.
c. Zurn Industries, LLC.
d. Sloan Valve Company

C. Fixture:
a. Rear over flow
b. Recessed self draining back
c. Concealed wall support
d. Vitreous china shroud
e. 3-hole facet, 4" center
f. Nominal size; 20.5" deep x 21 ¼" wide,
g. 1 ¼ trap

2.3 SENSOR-OPERATED LAVATORY FAUCETS **(P-2) and (P-3)**

A. Basis of design: American Standard: Innsbrook, Selectronic Electronic Proximity lavatory Facet. 605b

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
a. American Standard.
b. Kohler Co.
c. Zurn Industries, LLC.
d. Crane

C. Sensor-Operated Faucet with Remote Tempering Control**:** Vandal-resistant accessible faucet meeting ASME A112.18.1/CSA B125. ADA/ANSI A117.1 complaint.

1. ADA Compliant; Electronic Gooseneck Hand Washing Faucets operate by means of an infrared sensor. When the user enters the sensor's effective range, the Solenoid activates the water flow. Tempered water flows from the Faucet until the user steps away. The Faucet then automatically shuts off.

2. Body: Polished chrome plated commercial solid cast brass spout.

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3. Power; hard wired AC power. UL 1310, Class 2 certified. 2-piece plate-mounted power supply 120 VAC, 60 HZ.

4. Thermostatic mixing valve with 20" flexible inlet hoses with 3/8" compression fittings. ASSE 1070 certified down to 0.35 gpm/.

5. Aerator: Flow rate 1.5 gpm at operating range of 20 to 80 psi

6. Tempered Water Supply: Optional minxing valve Single thermostatic mixing valve.

7. Sensor Module: Water-conserving, vandal-resistant adjustable infra-red sensor unit with timing turn-off delay and stationary object automatic timed cutoff, with battery diagnostic audible signal, remote serviceable.
    a. Adjustable Sensing Distance: 0 to 3-1/2 inch (0 to 88.9 mm).

8. Power Supply: 120/24 VAC plug-in transformer.

9. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with stop/strainer/check valves, and flexible stainless-steel connectors.

10. Accessories:
    a. Splash-proof Circuit Control Module
    b. Adjustable Infrared Sensor Range
    c. Long Sensor Cable
    d. Self-cleaning Solenoid Valve with serviceable Strainer Filter
    e. appropriate Mounting Hardware
    f. Safery timer

11. Warranty: 1 year (limited)

12. Compliant to: ASME A112.18.1 and CSA B125.1

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Engineered Brass Co.
    b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    c. McGuire Manufacturing Co., Inc.
    d. Plumberex Specialty Products Inc.
    e. TCI Products.
    f. TRUEBRO, Inc.
    g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

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B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble fixtures, accessories, and associated fittings and trim in accordance with manufacturer's instructions.

B. Install fixture supports firmly attached to building structure.

C. Install fixtures level, plumb, and in accordance with manufacturer's rough-in instructions.

D. Install water supply piping. Provide stop on each supply in readily-serviceable location. Fasten supply piping to supports or substrate.

E. Install trap and waste piping to each fixture.

F. Install escutcheons at exposed piping penetrations in finished locations and within cabinets.

G. Seal joints between fixtures and walls, floors, and countertops with mildew-resistant silicone sealant meeting requirements in Division 07 Section "Joint Sealants."

H. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

I. Exposed metal trim and roughing shall be chrome plated nickel brass. Chrome plated cast brass ‘p’ traps with screw plug cleanout, slip-joint inlet and female cast swivel threaded elbow outlet. Chrome plated brass nipple to wall with chrome plated escutcheon. Swing spouts shall have 140° swing limit stops.

J. Wall hung lavatories, except as specifically noted otherwise, shall be supported on concealed chair carriers, single or double as required, with steel uprights, adjustable concealed arms and sleeves, alignment truss, and block bases. Carrier arms shall be provided with leveling device.

K. Provide chrome plated traps, nipples, stop valves, and supplies for fixtures supplied by other sections.

L. Provide protection shield guards on all exposed piping under sinks and lavatories.

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3.2 CLEANING AND PROTECTION

A. Repair or replace defective work, including damaged fixtures and components.

B. At time of Substantial Completion:

1. Clean unit surfaces, test fixtures, and leave in ready-to-use condition.

2. Install new batteries in battery-operated devices.

3. Fill soap dispensers.

4. Turn over keys, tools, maintenance instructions, and maintenance stock to Owner.

C. Protect units with water-resistant temporary covering. Do not allow temporary use of plumbing fixtures. Remove protection at Substantial Completion and dispose.

3.3 TESTING AND ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.

B. Test and adjust installation.

C. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

D. Operate and adjust controls. Replace damaged and malfunctioning units and controls.

E. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

F. Replace washers and seals of leaking and dripping faucets and stops.

END OF SECTION

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SECTION 224216.16 - COMMERCIAL SINKS

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. Service basins.
2. Utility sinks.
3. Handwash sinks.
4. Laminar-flow, faucet-spout outlets.
5. Supports.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

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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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 PANTRY SINK

A. Pantry Sink. Stainless steel, double counter mounted. **(P-5).**

B. Basis of design: American Standard, Montvale Stainless Steel Kitchen Sink Kit.

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
   a. Crane.
   b. Kohler Co.
   c. Zurn Industries, LLC.
   d. Sloan Valve Company

2. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Type: double bowl
   c. Number of Compartments: two
   d. Overall Nominal Dimensions: 33”x 22”x7 1/2” deep
   e. Metal: 18 gage stainless 304 stainless
   f. Thickness: 18 gauge
   g. Mounting: counter top – drop in
   h. 3 ½” strainer
   i. Compartment 1:
      1) 15 1/4”x18”x9”
      2) Drain: Grid 3 ½” with NPS 1 1/2 tailpiece and twist drain
      3) Drain Location: Centered in compartment
   j. Compartment 2:
      1) 12.5”x15 15/16”x7.5”
      2) Drain: Grid 2” with NPS 1 1/2 tailpiece and twist drain
      3) Drain Location: Centered in compartment

3. Supply Fittings:

   a. Standard: ASME A112.18.1/CSA B125.1.

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b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: lever handle.
2) Risers: NPS 1/2 ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

4. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):two

1) Size: NPS 1 ½" each
2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or wall flange.

5. Pull down Faucet:
a. Elkay model LKD2439C, Arc spout 2-5/8" lever handles ADA compliant, 1.5 max flow rate with ceramic disk valves.
b. Single hole
c. 11" height
d. Quarter turn ceramic disc valves
e. Facet holes 1- ¼"
f. 360 swivel
g. Spray and stream functions

6. Accessories:
a. Coordinated soap dispenser.

2.2 UTILITY SINK:

A. Stainless steel, counter mounted. **P-7**

B. Basis of design: Elkay Lustertone Classic Stainless Steel. Single Bowl drop in.

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
a. Crane.
b. Kohler Co.
c. Zurn Industries, LLC.
d. Sloan Valve Company

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Drop
c. Number of Compartments: One.
d. Overall Sink Dimensions: 33"x22"x 7 5/8" deep
e. Bowl Dimensions 28" x 16" x 7.5"

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f. Metal /Thickness: 304 stainless / 18 gauge
g. 4 hole.
h. Compartment:
   1) Drain: Grid 3 ½" with NPS 1 1/2 tailpiece and twist drain
   2) Drain Location: Centered in compartment

3. Supply Fittings:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

      1) Operation: Wheel handle.
      2) Risers: NPS 1/2 ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

4. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s):

      1) Size: NPS 1 ½"
      2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or wall flange.

5. Faucet:
   a. American Standard, model 6409 top mount goose neck faucet with spray.
   b. Arc spout 2-5/8" lever handles ADA compliant, 1.5 max flow rate with ceramic disk valves.
   c. 4 hole
   d. 13" height
   e. Quarter turn ceramic disc valves
   f. Facet holes 1- ¼"
   g. 360 swivel
6. Accessories:
   a. Aerator
7.

2.3 MOP SINK

A. Floor mounted **(P-9)**

B. Basis of design: Fiat Products; MSB2424

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
   a. Crane.
   b. Kohler Co.

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c. Zurn Industries, LLC.
d. Sloan Valve Company
e. Fiat

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Molded Stone
c. Single compartment
d. Floor mounted, one piece
e. 10” high walls x 1” think.
f. Retain "Compartment" Subparagraph below for single-compartment sinks.
g. Drain: 3 “with domed strainer

3. Options:

a. Model 830 AA service faucet, with stops, chrome plated vacuum breaker, adjustable wall bracket, pail hook, ¾” hose connection on spout.
b. Hose and hose bracket.
c. Mop hanger
d. 3” quick drain connector
e. Stainless steel bumper guards
f. Stainless steel wall guards.
g.

2.4 SERVICE SINK

A. Stainless Steel Service Sink **(P- 11)**.

B. Basis of design: Elkay Wall Hung sink kit, model ESSB2520C.

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
a. Crane.
b. Kohler Co.
c. Zurn Industries, LLC.
d. Sloan Valve Company

2. Fixture:

a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
b. Type: Floor Basin, high back for faucet, and support brackets.
c. Nominal Size: 25” x 19.5” x 24”
d. Bowl size: 22” x 16” x 12”
e. Drain: 3 ½”
f. Material; 14-gauge stainless steel. Buffed satin finish

3. Options:

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a. LK940BR03L2H Faucet
b. LK173 cast iron P trap

4. Mounting Height: as per manufacture.

2.5 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF 372 for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc; a division of Morris Group International.
3. NEOPERL, Inc.
4. T&S Brass and Bronze Works, Inc.

C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.6 SUPPORTS

A. Type II Sink Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. Wade Drains.
d. WATTS.
e. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

2.7 GROUT

A. Standard: ASTM C1107/C1107M, 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.

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2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Engineered Brass Co.
b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
c. McGuire Manufacturing Co., Inc.
d. Plumberex Specialty Products Inc.
e. TCI Products.
f. TRUEBRO, Inc.
g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. TRUEBRO, Inc.

2.9 Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

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C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball valves if supply stops are not specified with sink.
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

I. Provide protective shield guard for art room sinks and all Lavatories

J. Install clay / solids interceptors at all art room utility sinks.

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

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B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

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SECTION 224223 - COMMERCIAL SHOWERS

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. Commercial Shower System
2. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers and basins.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

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PART 2 - PRODUCTS

PART 3 - COMMERCIAL SHOWER SYSTEM

A. Commercial Shower System **(P-6)**

B. Basis of design: American Standard FloWise Commercial Shower System Kit. Model 1662SG

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
   1. Crane.
   2. Kohler Co.
   3. Zurn Industries, LLC.
   4. Sloan Valve Company

D. Fixture:
   Discreiption; Complete commercial shower system includes: pressure balance valve and trim, a wall supply with 1/2" NPT female inlet and 1/2" NPSM male outlet, a 59" metal shower hose, vacuum breaker, a 3-function personal shower with pause feature, and a 36" slide-grab bar.

   Valve is cast brass body, washerless ceramic disc valve cartridge with volume and temperature control, integrated check valves and hot limit safety stop. Pressure balancing cartridge maintains constant output temperature in response to changes in relative hot and cold supply pressure. Universal inlets/outlets with screwdriver stops. Rough-in plaster guard designed for use as thin wall mounting adapter. Durable metal handle. 3-function water saving hand shower with pause feature and 1.5 gpm flow restrictor. Slide bar features an adjustable hand shower holder which can be set at any height or position along the bar and angle up to 45˚.

   1. Universal Inlets / Outlets: 1/2" NOM Copper Sweat or 1/2" NPT.
   2. Cast Brass Valve Body: Durable. Ideal material for prolonged contact with water.
   3. Ceramic Disc Valve Cartridge: Allows easy control over both water temperature and volume.
   4. Pressure Balancing Valve Cartridge: Maintains constant output temperature in response to changes in relative hot and cold supply pressure. Diaphragm system with integrated check valves engineered to eliminate cross flow. Avoids failure due to mineral deposits - ideal for use in hard water.
   5. Back-to-Back Capability: Hot and cold can be reversed quickly and easily.
   6. Adjustable Hot Limit Safety Stop: Limits the amount of hot water allowed to mix with cold. Reduces the risk of accidental scalding.
   7. Exclusive Plaster Guard: Plaster guard is designed to protect valve during installation and serve as a mounting plate for thin-wall installations. Two-piece design allows valve to be tested prior to trim installation.
   8. Wide Rough-in Range: From 1-5/8" to 3-1/4".
   9. Water Saving: Saves 40% in water usage.
   10. ADA-Compliant: Non-positive shut-off button on handle reduces flow to a trickle.
   11. Stronger Than Standard Slide Bars: 1-1/2" diameter stainless steel bar meets ANSI standard 250 lb. pull test.

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12. Chrome-plated hand shower holder with ADA compliant lever handle.

13. GCopy "Individual PMMA Showers" Paragraph below and re-edit for each type of individual PMMA shower required.

3.2 GROUT

A. Standard: ASTM C1107/C1107M, 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 4 - EXECUTION

4.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

4.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523.12 "General duty valves for Plumbing Piping".

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set shower receptors and shower basins in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

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G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

4.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

4.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

4.5 CLEANING AND PROTECTION

A. After completing installation of showers and basins, inspect and repair damaged finishes.

B. Clean showers and basins, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective plastic covering for installed fixtures and fittings. Cover the entire shower stall opening with plastic.

END OF SECTION 224223

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SECTION 22 45 00 EMERGENCY PLUMBING FIXTURES

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. Eyewash equipment.
2. Supplemental equipment.
3. Water-tempering equipment.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

B. Field quality-control test reports.

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1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.7 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. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

PART 2 - PRODUCTS

2.1 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. ISEA Standard: Comply with ISEA Z358.1.

C. NSF Standard: Comply with NSF 61 and NSF 372, for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC A117.1,; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

2.2 EYEWASH EQUIPMENT

A. Standard, Freestanding, Plumbed Eyewash Units **(P-10)**

B. Basis of design: Acorn Model S0440-BF, barrier free wall mounted

C. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
   a. Guardian
   b. Bradley
   c. Haws
   d. Speakman

D. Fixture;
   a. Stainless steel bowl
   b. ABS plastic spray heads with cover
   c. Inline strainer
   d. Stay open 1/” ball valve with push handle
   e. Integral 3.7 gpm flow control valve
   f. Water Supply: 1/2" NPT female threaded, chrome plated brass inlet.
   g. Waste: Chrome plated brass, 1-1/4" OD tailpiece.
   h. Bowl: Stainless steel, 11-3/4" diameter bowl.

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i. Mounting: 11 gage galvanized steel wall bracket with a yellow powder coated finish.
j. Universal Sign: ANSI compliant, vertical identification sign.

E. Optional Accessories:
a. Thermostatic mixing valve is ASSE Listed per the ASSE 1071 standard. The tepid output water complies with ANSI Z358.1 standard. Valve includes Ball Valve Shut-offs and Outlet Temperature Gauge
b. P-trap, chrome plated brass with 1-1/4" OD waste outlet
c. Scald protection valve
d. Stainless steel ball valve

2.3 ALTERNATIVE WATER-TEMPERING VALVE

A. Electric Water-Tempering Equipment,

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Guardian
b. Watts
c. Bradley

B. Application; Tempering valve to blend hot and cold water to deliver tepid water. Valve has flow capacity of 2 to 6 gallons per minute (GPM). Valve can be used with an eyewash, eye/ face wash, dual purpose eyewash/drench hose or drench hose unit.

C. Fail Safe: In event of restriction or failure of hot water supply, internal bypass allows valve to deliver cold water to emergency unit. In bypass mode, valve will deliver 4 GPM of cold water at 30 PSI flow pressure. In event of loss of cold water supply, valve will close to prevent scalding and not deliver water.

D. Supply Temperature: Minimum recommended hot water supply temperature is 120°F

E. Supply Pressure: 30 PSI minimum supply pressure is required for proper valve operation. Maximum supply pressure is 125 PSI. Maximum hot to cold water pressure differential is 5%.

F. Mounting: Furnished with heavy duty mounting bracket for securing valve to panel or wall.

G. Inlets: 1/2" nominal sweat female hot and cold-water inlets. Each inlet has check valve and supply stop.

H. Outlet: 1/2" NPT female outlet.

I. Quality Assurance: Valve is completely assembled and water tested prior to shipment. Valve is certified to ASSE 1071. Valve is certified to meet low lead requirements of wetted surface area less than 0.25% lead by weight.

J. Accessary cabinet - valve is installed in surface mounted stainless-steel cabinet.

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2.4 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures, to facilitate maintenance of the equipment. Use ball valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523. "Valves for Plumbing Piping".
   1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

J. Fill self-contained fixtures with flushing fluid.

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3.3 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."

C. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

F. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

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3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

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SECTION 224716 - WATER COOLERS AND BOTTLE FILLERS

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 pressure water coolers with bottle filler and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers 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. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 5 of each.

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PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS **(Not Used)**

A. Pressure Water Coolers: Wall mounted, wheelchair accessible, with bottle filler, vandal resistant.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkay Manufacturing Co.
   b. Halsey Taylor.
   c. Haws Corporation.
   d. Oasis International.

2. Standards:

   a. Comply with NSF 61 and NSF 372.
   b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
   c. Comply with ICC A117.1.

3. Cabinet: single-level with attached cabinets and skirt kit, all stainless steel.
4. Bubbler: One, with adjustable stream regulator.
5. Control: Push buttom
6. Bottle Filler: Push-button activation with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm.
7. Drain: Grid with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Ventilation Grille: Stainless steel.
10. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
11. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
12. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

13. Capacities and Characteristics:

    a. Cooled Water: 5 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.

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e. Cooled-Water Storage: .
f. Electrical Characteristics: refer to drawing schedule

14. Support: Type I Water or Cooler Carrier Type II Water Cooler Carrier as recommended by the manufacture.
15. Water Cooler Mounting Height: Handicapped/elderly according to ICC A117.1.
16. Cabinet: All stainless steel integral with drinking fountain water cooler.
17. Bottle filler: electronic hands free activation with 20-second automatic shut-off timer. Fill rate 0.5 to 1.5 gpm.
18. Support: Mounting frame for attaching to substrate.

2.2 BOTTLE FILLING STATION **(P-8)**

A. Recessed wall mounted, wheelchair accessible, with bottle filler, vandal resistant, hands free with filtration.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkay Manufacturing Co.
   b. Halsey Taylor.
   c. Haws Corporation.
   d. Oasis International.

2. Standards:

   a. Comply with ADA & ICC A117.1
   b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
   c. Comply with ICC A117.1. and ADA

3. Cabinet: all stainless steel.
4. Bubbler: none.
5. Control: Sensor activation. Hands free.
6. Bottle Filler: Fill rate 8 gpm.
7. Drain: Grid with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Ventilation Grille: Stainless steel.
10. Visual Filter Monitor: LED Filter Status Indicator for when filter change is necessary.
11. Filter is certified to NSF 42 and 53 for lead, particulate, chlorine, taste and odor reduction. 3,000 gal. capacity.
12. Silver Ion Antimicrobial protection on key plastic components to inhibit the growth of mold and mildew.
13. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
14. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

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15. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

16. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics: refer to drawing schedule 370 watts,115v/60hz, 1.0 amp
17. Support: Type I Water or Cooler Carrier Type II Water Cooler Carrier as recommended by the manufacture.
18. Water Cooler Mounting Height: Handicapped/elderly according to ICC A117.1.
19. Cabinet: All stainless steel integral with drinking fountain water cooler.
20. Bottle filler: electronic hands free activation with 20-second automatic shut-off timer. Fill rate 0.5 to 1.5 gpm.
21. Support: Mounting frame for attaching to substrate.

2.3 SUPPORTS

A. Type I Water Cooler Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. Wade Drains.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

B. Type II Water Cooler Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. Wade Drains.
    d. WATTS.
    e. Zurn Industries, LLC.

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2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and in-wall bottle filling stations to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Valves for Plumbing Piping" and Section 220523.15

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

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B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Valves for Plumbing Piping"

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

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SECTION 230529 - COMMON WORK RESULTS FOR HVAC

PART 1 -

1.1 RELATED DOCUMENTS

A. These basic Mechanical Requirements apply to all Division 23 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all HVAC and related work for this project, as required by the contract documents.

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 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER RESPECTIVE SECTIONS OF THIS DIVISION

A. Motor starters shall be furnished under this Division. Refer to Specification Section 230513 Common motor requirements for HVAC equipment" for technical information.

1.4 REFERENCES

A. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.

B. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

C. ASME - American Society of Mechanical Engineers.

D. UL - Underwriters Laboratory.

E. NFPA - National Fire Protection Association.

1.5 REGULATORY REQUIREMENTS

A. 2020 New York State Building Code,

B. 2020 New York State Mechanical Code,

C. 2020 New York State Energy Conservation Code,

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D. Obtain permits, and request inspections from authority having jurisdiction.

1.6 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.8 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all mechanical work and related work including but not limited to the following:
1. Boilers and specialties
2. Hydronic piping specialties, valves and fitting
3. Hot water pumps.
4. In floor radiant heating system, piping valves specialies, and controls
5. Split system VRF heat pumps
6. Gas fired unit heaters
7. Fans.
8. Hot water and chilled water coils.
9. Ductwork and specialties.
10. Pipe and duct insulation.
11. Equipment Supports
12. Automatic temperature controls.
13. Grilles, registers, louvers, and diffusers.
14. Vibration isolation.

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15. Motor starters and disconnects.
16. Protection.
17. Identification.
18. Coordination.
19. Phasing.
20. Rigging.
21. Testing and Balancing Reports Air and Water.
22. Shop Drawings.
23. As-Built Drawings and Maintenance Manuals.
24. Warrantees.
25. Commissioning

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Where corrosion can occur, appropriate corrosion resistant materials and assembly methods must be used including isolation of dissimilar metals against galvanic interaction. Resistance to corrosion must be achieved by the use of the appropriate base materials. Coatings shall be restored to only when specifically permitted by the Specification.

C. Construct all equipment in accordance with requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

D. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with manufacturer’s recommendations.

E. Provide all controls, wiring, piping, valves, accessories and other components necessary to make all systems complete and operable.

F. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

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3.2 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 1)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of the all items listed in the following paragraphs.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all Mechanical equipment noted, scheduled on plans and as and specified including but not limited to the following:
1. Automatic Temperature Controls, Operation Sequences & Wiring Diagrams, and Control Diagrams hardware and software
2. Motor Starters and Controllers
3. Hydronic piping and specialties
4. Expansion Tanks
5. Air handling units and supports
6. Condensing units
7. Fans
8. Boilers
9. Pumps and bases
10. Vibration isolation
11. Fans
12. Hangers and Inserts
13. Equipment Supports and Vibration Eliminators
14. Sheet Metal Construction Standards
15. Piping Layout (1/4 scale)
16. Ductwork Layout (1/4 scale)
17. Insulation (piping and ductwork)
18. Piping, Valves, fittings, and Specialties
19. Filters
20. Fan Curves and Sound Rating
21. Coils
22. Fire dampers, Motorized Dampers, Smoke dampers
23. Diffusers Registers and Grilles
24. Balancing Reports, Air and Water
25. Coordinated Composite Drawings on Mylar with Piping, Ductwork, Conduits, Lights, registers Grilles and Smoke Detectors, etc.

D. The contractor shall, upon award, submit a schedule for the engineer’s review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manner as the project progresses in accordance with the Construction manager or General contractor’s work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

E. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

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F. Sheet metal shop drawings shall indicate all existing and/or new lights, walls, piping, structural elements, existing work, etc. and dimension locations of ductwork including elevations in relation to these items.

G. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications. It does not relieve the contractor of the responsibility to perform all work to accepted industry standards and in a code compliant manor. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

H. Where substitutions are submitted for approval the review shall be for general performance comparison to the specified product. Products shall not be reviewed for size, clearance or coordination with other trades. Coordination with other trades shall be the responsibility of the contractor. And changes to existing conditions or changes required to the work of other trades such as a result of substituted material or equipment approved or not shall be the responsibility of this contractor.

I. Approval of shop drawings

1. The Contractor shall be specifically responsible for checking equipment dimensions and clearances and confirming that equipment will fit into the designated space and connect properly to adjoining equipment and/or materials.

2. Submittals marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Amend and Resubmit", corrected drawings must be resubmitted for final review.

3. Submittals marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

4. Submittals marked "Rejected" or "Amend and Resubmit" shall include a specific written response to the engineer’s comments. Resubmission of a submittal without a written response to the engineer’s comments will be considered incomplete and shall be returned un-reviewed.

3.3 CHARTS AND TAGS

A. The Contractor shall provide three sets of charts and diagrams of all piping systems indicating the number and location of valves, controls, etc.

B. All valves, dampers, and controls shall be designated with brass tags. Refer to section 23 05 23 Identification for HVAC Piping and equipment

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3.4 PAINTING

A. All motors, fans and all other factory manufactured and assembled apparatus shall be factory coated with one coat of primer and one coat of machinery enamel standard color at the factory and after installation, all finishes shall be cleaned and touched up to repair any damage incurred during construction.

B. All piping shall be painted in colors conforming with OSHA Standards. All new and existing exposed iron and supplementary dunnage steel shall be finished according to specifications.

C. All supports, nuts, bolts and hanger fasteners located outside shall be galvanized or nickel plated.

3.5 RIGGING

A. Furnish all labor, materials and equipment required to rig equipment and materials.

B. The rigger shall secure any necessary permits and comply with all applicable Federal, State and local safety regulations. A copy of permits to be kept at both the project site and Engineer's Office.

C. The rigger shall have a minimum of five (5) years of practical experience and hold a master riggers license if required.

D. The procedure for rigging shall be submitted to the Engineer for review. All possible precautions should be taken to prevent damage to the structure, streets, sidewalks, curbs, lawns, etc.

3.6 CUTTING AND PATCHING

A. All cutting and patching required for piping, ductwork, control conduits, etc., passing through walls, floors, and roof shall be provided by this Contractor under this contract unless otherwise noted. This Contractor shall be responsible for any damage done to the structure due to his negligence.

B. Patching materials and application shall match existing construction.

C. Where applicable, new holes for piping installation shall be core drilled.

D. Pipe Sleeves & Fire-stopping:

1. Provide for all pipes, conduits ducts, and other elements passing through floors, walls, partitions and structural elements, sleeves as specified. Sleeves shall be of adequate diameter to allow for a minimum of 3/4 inches clear all around sleeve and pipe. When pipe, conduit ducts or other such element penetrates other than fire rated assembly and is insulated, insulation shall pass continuously through sleeves with 1/2 inch clearance between insulation and sleeve.

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2. Where pipes, conduits and other such elements penetrate fire rated assemblies, or where holes or voids are created to extend mechanical systems through fire rated assemblies (walls, floors, ceilings, structure, etc.); sleeves and fire-stopping systems shall be installed.

E. Furnish access doors, to the General Contractor for installation where required in finished walls, partitions and the like for access to junction boxes, controls, valves, etc, concealed behind finished construction.

F. Submit location drawings and sizes for review prior to installation.

3.7 PROTECTION-COORDINATE WITH DIVISION 1

A. Special protection is required for installation of a Derrick or other device for rigging purposes. This Contractor shall coordinate with the rigger to facilitate rigging work.

B. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring on to adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for conduit, pipe, ductwork, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and watertight.

G. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together

3.8 EQUIPMENT SUPPORTS

A. A.Provide supplementary steel dunnage, curbs, angle iron stands, etc., to properly set and install all equipment, including supports necessary to properly pitch piping.

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3.9 WELDING

A. A.Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

C. Provide all temporary ventilation, and ventilation air systems required during welding operations as required by OSHA.

3.10 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all new and existing equipment, piping, and ductwork in the entire building. Schedules shall be revised to indicate actual equipment installed.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1 and shall be submitted in paper format for review. Accepted as builts shall then be submitted in AutoCAD format on hard disc.

3.11 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.12 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

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C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.13 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.14 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction and/or knock-down of equipment to suit conditions. Special attention should be given to equipment installation. Provide all labor and material to facilitate installation.

3.15 COOPERATION WITH OTHER TRADES PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

B. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

C. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipments, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, ductwork, equipment, diffusers and grilles.

D. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the HVAC contractor shall submit a schedule in writing to the Architect and owner for approval. There shall be no shut downs of any systems without prior written approval from the owner. The contractor shall include in his bid all costs associated with providing temporarily piping controls, ductwork and fans and air conditioning units to maintain operations in the phase II area while work is being performed on the Phase I area. It shall also be noted that ductwork, piping and controls will have to be extended through the phase II work areas in order to reach the area(s) under construction in

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phase I as part of this work. The contractor shall include in his bid all provisions to perform such phasing work

3.16 CLEANING

A. It is the intent of the contract documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.17 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer and in accordance with generally accepted industry good practice.

3.18 FIRE PREVENTION DURING HOT WORK

A. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully-charged, operable portable fire extinguisher to each fire watcher.

B. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

C. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.19 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

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D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks. Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the days work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall cleanup the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.20 USE OF OWNERS EQUIPMENT

A. The contractor shall not use any the owner’s HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation, or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

END OF SECTION

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SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 24 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.4 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 70 - National Electrical Code.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL Component Recognition for appropriate sizes.

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B. Conform to NFPA 70 applicable electrical code, Underwriters Laboratories, Inc., and NEMA

C. Conform to I ECC 2015

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WARRANTY

A. Provide five year manufacturer warranty for all motors larger than ½ horsepower.

PART 2 - PRODUCTS

MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Gould.
2. Century.
3. General Electric.
4. Square D

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

C. All electric motors of sizes and types as specified for driving mechanical equipment shall be provided under this section.

D. Electrical Service: All motors shall be 60 Hertz unless otherwise noted. Refer to Electrical Specifications for required electrical characteristics.

E. Motors: Design for continuous operation in 40° C environment, and for temperature rise in accordance with ANSI/NEMA MG limits for insulation class, Service Factor, and motor enclosure type. Motors shall be of sufficient size for duty to be performed.

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F. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency, power factor.

G. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame. Size motor boxes to receive motor feeders and ground cable indicated on electrical drawing schedules.

H. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

I. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 MOTOR EFFICIENCY

A. Electric motors shall meet the minimum efficiency requirement of the following tables in accordance with International Energy conservation code when tested in accordance with DOE CFR 431. Performance data shall be certified by approved testing agency.

B. Subtype I motors – NEMA premium efficiency as per table NEMA MG 1 table 12-12 and International Energy Conservation code table 405.8(1). This shall apply to general purpose, T-frame, single speed, squirrel cage, induction type; 230/460-V, NEMA Designs A or B, continuous rated, 60 Hz, from 1 to 200 hp, 2-, 4- and 6-pole (3600-, 1800- and 1200-rpm), open and enclosed. Subtype I motors 250 hp to 500 hp motor efficiency shall be able NEMA MG 1 table 12-11 and International Energy Conservation Code table 405.8(1).

C. Subtype II motors – NEMA efficiency as per table NEMA MG 1 table 12-11 and International Energy Conservation code table 405.8(2). This shall apply to general purpose motors but can configured as U-frame motors; NEMA Design C motors; close-coupled pump motors; footless motors; vertical solid shaft normal thrust motors (as tested in a horizontal position); eight-pole (900 rpm) motors, and polyphase motors with a voltage of not more than 600 V (other than 230 or 460 V).

D. Minimum average full load efficiency of polyphase small electric motors up to 3 hp shall be in accordance with Table C405.8(3) of the International Energy Conservation Code

E. Minimum average full load efficiency for capacitor-start, capacitor-run and capacitor-start induction-run small electric motors up to 3 hp shall be in accordance with Table C405.8(4) of the International Energy Conservation Code.

2.4 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

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B. Service Factor: 1.15.

C. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt centre line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.

H. Sound Power Levels: To NEMA MG 1.

I. Temperature Rise: Match insulation rating.

J. Insulation: Class B or better.

K. Code Letter Designation:

1. Motors [15] HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.5 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Use part winding Start above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

C. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

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1. **Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.**
2. **Premium-Efficient Motors: Class B temperature rise; Class F insulation.**
3. **Inverter-Duty Motors: Class F temperature rise; Class H insulation.**
4. **Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.**

D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, pre-lubricated sleeve ball bearings.

2.7 POWER FACTOR CORRECTION

A. Provide a capacitor for each three phase, single speed motor rated 3 HP or larger shall be provided to correct the full load power factor to 95%. The capacitor shall be mounted at the motor for connection across the motor terminals by Electrical Contractor

B. Capacitors;
1. Capacitors shall be totally enclosed, fused and with discharge resistors.
2. Capacitors based on nominal motor RPM shall be provided in accordance with the following table to correct power factor to 95% and verify sizes with motor manufacturer.

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Motor HP	Capacitor KVAR 3600 RPM Motor	Capacitor KVAR 1800 RPM Motor
3	1.5	1.5
5	2	2
7.5	2.5	2.5
10	3	3
15	4	4
20	5	5
25	6	6
30	7	7
40	9	9
50	12	12
60	14	14

2.8 STARTERS

A. GENERAL

1. See specification Section 16485 and Division 1 for additional information.
2. Starters for motors operating at 120 volts shall be manual starters unless otherwise indicated. Starters for motors operating at other than 120 volts shall be magnetic starters.
3. All starters shall be enclosed. Enclosures shall be surface mounted NEMA 1 unless otherwise indicated.
4. Where weatherproof starters are required, the enclosure shall be NEMA 4.
5. It shall be verified that the correct overload heaters have been installed in the starter before energizing any motor. Sizing shall be based on motor nameplate current and taking into account any reduction in current due to power factor correction.
6. Alternate Manufacturers –
   a. Allen-Bradley
   b. Crouse-Hinds Co.
   c. Cutler-Hammer, Inc.
   d. General Electric Co.
   e. Square D Co.
   f. Westinghouse Electric Corp.

B. MANUAL STARTERS

1. Two-pole, toggle operated, thermal overload device in each phase leg, handle guard for padlocking toggle handle and with indicated control and signal devices.

2. Where a motor is controlled automatically by an interlock or pilot device, a “HAND-OFF-AUTO” switch shall be provided in the starter cover. Where the rating of the interlock or pilot device is inadequate to control the motor currents directly, a properly rated contactor shall be provided between the controlling device and the motor.

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3. An "ON" pilot light shall be provided in the starter cover.

C. MAGNETIC STARTERS

1. Starters shall be sized in accordance with NEMA standards and the following table except that starters shall not be smaller than NEMA size 0. Starters shall be provided with one N.O. electrical holding interlock, under voltage protection and two additional auxiliary contacts within the same enclosure. NEMA size starters shall be provided as follows

STARTER SIZE	MAX HP AT 460 VOLTS
0	5
1	10
2	25

2. All starters shall be combination type with the starter and disconnect in the same enclosure. All starters shall be Type 2 coordination protected. Fuses shall be Bussman "Low Peak" type or equal sized at 125% of motor nameplate rating. Verify and coordinate requirements for fused disconnect switches with the Electrical Contractor prior to ordering starters.

3. Provide S.S.P.B. or H-O-A switches and pilot light in covers as required to facilitate control operation sequences.

D. CRITICAL FAULT

1. Where starters are not integral to equipment and are furnished and installed separately from equipment by the contractor, provide a 3 phase line voltage monitor by ICM Controls model 450 or approved equal. Unit shall be installed in the motor starter or in a separate enclosure with the same rating as the starter. It shall be arranged to monitor critical faults including phase loss or reversal, and when detected, de-energize the load. It shall monitor non-critical faults including high/low voltage, voltage unbalance and when detected, after a time delay de-energize the load.

PART 3 - EXECUTION

A. Suitable starting and controlling equipment and devices shall be furnished and installed as specified hereinafter and as shown on the Drawings. The starting equipment shall be arranged, generally, in control groups, or in certain cases, as isolated combination starters as specified or indicated. The Heating Ventilating and Air Conditioning Sequences of Operation, drawings and

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specifications shall be referred to for the manner of control, operation and monitoring of motors and the electrically operated equipment.

B. A starter and disconnect switch or combination motor starter disconnect shall be provided for every motor and each and every electrically operated piece of equipment by this contractor except where complete starters and controls are furnished by the manufacturer of the motor or piece of equipment. Starters shall be internally wired to provide the required control operation and monitoring. All control devices such as push buttons, break-glass stations, alternators, relays, pilot lights, etc., shall be provided as required for operation of mechanical equipment. All roof top and remotely located equipment shall have remote starters as located on plan and shall have local disconnect switches. All equipment located in equipment rooms can use combination starters/disconnects located within line of site of controlled equipment. All starters and disconnect switches shall be in enclosures suitable for the environment in which they are installed. Starters and disconnect switches located in machine rooms shall use NEMA 1. Starters and disconnect switches located outdoors shall use NEMA 4x. Starters and disconnect switches located in machine rooms which are subject to potential water damage shall use NEMA 2

C. Starting equipment and devices specified in this section and section 23 29 13 Variable Frequency Controllers, shall be furnished by the mechanical subcontractor and shall be installed by the Electrical subcontractor. In general, the mechanical subcontractor shall furnish all motor starters and disconnect switches except where they are an integral part of a motor control center, in this case starters and disconnects shall be provided, (furnished and installed), by the electrical contractor. The Electrical subcontractor shall also provide all wiring necessary to supply power to the electric motors specified under this section, including connections from the starters to the motors. Starters and disconnects shall also include variable frequency drives.

D. The mechanical Contractor shall furnish and install all wiring between control devices and controlled equipment furnished under this Section, including interlock control wiring between motor starters, and all automatic temperature control wiring. All wiring shall be installed in conformance with applicable codes and the requirements of the Electrical Division of the Specifications.

E. The Electrical Contractor shall furnish a 120-volt power source to temperature control panels and equipment requiring a separate 120-volt control power source. Power for control circuits for all devices connecting to motor starters shall be obtained from 120-volt control transformers provided in each starter operating at other than 120 volts. Provide transformers for all low voltage control systems as required.

F. Furnish detailed composite wiring diagrams and such other information necessary to assure the proper connection, operation and control of motorized equipment, including interlocks, automatic controls, safety controls and all auxiliary circuits.

G. All control units shall be furnished with a nameplate indicating which device or equipment it controls, the voltage. Additional nameplates on each push button, selector switch and pilot light indicating their functions shall be provided. Nameplates shall be laminated phenolic with white letters on black background, minimum 2” high.

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H. All motors supplied either with equipment or installed separately that are to be used in conjunction with variable frequency drive shall be inverter duty motors.

END OF SECTION 230513

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SECTION 230517 - SLEEVES AND ESCUTCHEONS FOR HVAC 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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Escutcheons.
7. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

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F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Airex Manufacturing.
3. CALPICO, Inc.
4. Metraflex Company (The).
5. Link Seal

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. GPT; an EnPro Industries company.
3. Metraflex Company (The).
4. Proco Products, Inc.
5. Fernco

B. Description: Manufactured heavy rubber or EPDM, sleeve-to-pipe water stop assembly. Unit has rubber water stop collar with center opening to match piping OD. Connected with stainless steel hose clamps. Made for copper or plastic carrier pipes. Size up to 4” sleeve and 3” carrier pipe.

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2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, 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.

2.6 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.7 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

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2. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. 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 for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration,

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assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

C. Coordinate the minimum size of sleeves with the pipe. Sleeves for plumbing piping shall be 2x the diameter of the service pipe.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls <u>above and below</u> Grade:

   a. Piping Smaller Than NPS 3: Galvanized-steel wall sleeves with Sleeve-seal fittings.
   b. Piping NPS 3 and Larger: Galvanized-steel wall sleeves with sleeve – seal system.

2. Concrete Slabs-on-Grade:

   a. Piping all sizes: Galvanized-steel wall sleeves with sleeve-seal system.

3. Concrete Slabs above Grade:

   a. Piping All sizes: Galvanized-steel-pipe sleeves or Stack-sleeve fittings with Sleeve-seal fittings.

4. Interior Partitions:

   a. Piping all sizes, concreate or masonry walls: Galvanized-steel-pipe sleeves.
   b. Piping all sizes, non-masonry walls: Galvanized-steel-sheet sleeves

3.6 ESCUTCHEON INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

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B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.7 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230517.5

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SECTION 230519 - METERS AND GAGES FOR HVAC 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. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Thermowells.
5. Dial-type pressure gages.
6. Gage attachments.
7. Test plugs.

B. Related Sections:

1. Section 232113 "Hydronic Piping"

1.3 ACTION SUBMITTALS

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

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

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PART 2 - PRODUCTS

2.1 Thermometer Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts; a Watts Water Technologies company.
3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

2.2 BIMETALLIC-ACTUATED THERMOMETERS

1. Standard: ASME B40.200.
2. Case in first paragraph below will typically be the sealed (dry) type. Hermetically sealed cases are available.
3. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
4. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
5. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
6. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
7. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
8. Window: Plain glass.
9. Ring: Stainless steel.
10. Element: Bimetal coil.
11. Pointer: Dark-colored metal.
12. Accuracy: Plus or minus 1 percent of scale range.

2.3 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Pointer: Dark-colored metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

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11. Accuracy: Plus or minus 1 percent of scale range.

2.4 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

   a. Design for hydronic Installation: With ventilated shroud.
   b. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

   a. Design for hydronic Installation: With ventilated shroud.
   b. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.

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6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Trerice, H. O. Co.
b. Watts; a Watts Water Technologies company.
c. Weiss Instruments, Inc.
d. Weksler Glass Thermometer Corp.

B. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.

2. Case: Liquid-filled Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

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2.8 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts; a Watts Water Technologies company.
3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install permanent indicators on walls or brackets in accessible and readable positions.

J. Install connection fittings in accessible locations for attachment to portable indicators.

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K. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.

L. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

END OF SECTION 230519

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SECTION 230523.11 - VALVES FOR HVAC 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. Bronze angle valves.
2. Globe valves.
3. Ball Valves
4. Butterfly Valves.
5. Check Valves
6. Gate Valves

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 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 and globe valves closed to prevent rattling.

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.

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C. 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. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.1 for power piping valves.
6. ASME B31.9 for building services piping valves.

C. Refer to HVAC valve schedule articles for applications of valves.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valves in Insulated Piping:

1. Include 2-inchstem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

G. Valve Actuator Types:

1. Gear Actuator: For valves NPS 8 and larger.
2. Handlever: For valves NPS 6 and smaller.
3. Chainwheel: Device for attachment to gear, stem, or other actuator of size and with chain for mounting height, according to "Valve Installation" Article.

H. .Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Stockham; Crane Energy Flow Solutions.

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f. Watts; a Watts Water Technologies company.
g. Keystone

GLOBE VALVES

2.2 BRONZE GLOBE VALVES

A. Class 125 Bronze Globe Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
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 150 Bronze Globe Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Bronze or PTFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GLOBE VALVES

A. Class 125 Iron Globe Valves:
1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

B. Class 250 Iron Globe Valves:

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1. Description:

    a. Standard: MSS SP-85, Type I.
    b. CWP Rating: 500 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Packing and Gasket: Asbestos free.
    g. Operator: Handwheel or chainwheel.

BALL VALVES

2.4 BRASS BALL VALVES

A. One-Piece Brass Ball Valves:
    1. Description:

        a. Standard: MSS SP-110.
        b. CWP Rating: 400 psig.
        c. Body Design: One piece.
        d. Body Material: Forged brass.
        e. Ends: Threaded.
        f. Seats: PTFE.
        g. Stem: Brass.
        h. Ball: Chrome-plated brass.
        i. Port: Reduced.

B. Two-Piece Brass Ball Valves with Full Port and Brass Trim:
    1. Description:

        a. Standard: MSS SP-110.
        b. SWP Rating: 150 psig.
        c. CWP Rating: 600 psig.
        d. Body Design: Two piece.
        e. Body Material: Forged brass.
        f. Ends: Threaded.
        g. Seats: PTFE.
        h. Stem: Brass.
        i. Ball: Chrome-plated brass.
        j. Port: Full.

C. Two-Piece Brass Ball Valves with Full Port and Stainless-Steel Trim:
    1. Description:

        a. Standard: MSS SP-110.
        b. SWP Rating: 150 psig.
        c. CWP Rating: 600 psig.

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d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

D. Two-Piece Brass Ball Valves with Regular Port and Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

E. Two-Piece Brass Ball Valves with Regular Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Brass or bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

2.5 BRONZE BALL VALVES

A. One-Piece Bronze Ball Valves with Bronze Trim:
1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze.

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h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. One-Piece Bronze Ball Valves with Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

C. Two-Piece Bronze Ball Valves with Full Port and Bronze or Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Two-Piece Bronze Ball Valves with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

E. Two-Piece Bronze Ball Valves with Regular Port and Bronze or Brass Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.

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c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

F. Two-Piece Bronze Ball Valves with Regular Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

2.6 IRON BALL VALVES

A. Class 125 Iron Ball Valves:
1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.7 BRONZE LIFT CHECK VALVES

A. Class 125 Lift Check Valves with Bronze Disc:
1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.

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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. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR or PTFE.

2.8 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE.

2.9 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.

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g. Trim: Bronze.
h. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Composition.
h. Seat Ring: Bronze.
i. Disc Holder: Bronze.
j. Disc: PTFE.
k. Gasket: Asbestos free.

2.10 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring.

GATE VALVES

A. Class 125, RS, Bronze Gate Valves:
1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
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.

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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 valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. 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.

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3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Throttling Service except Steam: Globe valves.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For valves exposed to fuel, oil gasoline or other hydrocarbons use NBR nitrile-butadiene rubber, gaskets and seats.
8. For valves exposed to glycol, UV and hydronic applications EPDM gaskets and seats.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze angle or globe valves, Class 125, Class 150, bronze nonmetallic disc, with soldered or threaded ends.

B. Pipe NPS 2-1/2 and Larger: Iron globe valves, Class 250 with flanged ends.

END OF SECTION 230523.11

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.

B. Related Sections:

1. Section 232113 "Hydronic Piping"

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

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

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B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

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2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Clement Support Services.
2. ERICO International Corporation.
3. National Pipe Hanger Corporation.
4. Pipe Shields Inc.
5. Piping Technology & Products, Inc.
6. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Hot and cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

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C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

C. Flashing;
Metal Flashing: 26gage galvanized steel.

1. Metal Counter-flashing: 22 gage thick galvanized steel.

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2. Flexible Flashing: 47 mil thick sheet butyl or other material compatible with roofing. Verify with roofing manufacturer.

3. Caps: Steel, 22-gage minimum; 16 gage at fire resistant elements.

D. Sleeves:
1. Ductwork Sleeve 18 gauge Installation and Closure for Fire Rated Walls and Floors: Fire damper assembly with continuous angles on all sides as per NFPA-90A requirements.

2. Provide and install sleeves for all penetrations in accordance with Division 1.

E. Escutcheons;
1. Chrome plated cast brass escutcheons with set screws on all exposed piping at wall penetrations in finished spaces.

F. Hanger Rods:
1. Hanger Rods: Hot rolled steel threaded both ends, threaded one end, or continuous threaded. In accordance with the following schedule.

HANGER ROD SIZE SCHEDULE	
Pipe Size (in)	Min Rod Dia (in)
¾” to 2”	3/8”
½” to 3-1/2”	½”
4” to 5”	5/8”
6”	¾”
8” to 12”	7/8”
14”	1”
16” to 18”	1-1/8”
20”	1-1/4”
24”	1-1/2”
30”	1-7/8”

2. Hanger spacing shall be in accordance with the following schedule for maximum allowable distance. Provide hanger all changes in direction.

PIPE SUPPORT SPACING SCHEDULE		
Pipe Material/ Size (in)	Maximum Horizontal Spacing (ft)	Maximum Vertical Spacing (ft)
Steel		
Up to 1 ¼”	8	15
1 ½” to 2 ½”	10	15
3” and over	12	15
Copper Pipe	8	10
Copper Tubing		
Up to 1 ¼”	6	10
1 ½” and over	8	10

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PVC / HDPE		
Up to 1”	3	10
1 1/4” and over	4	10

3. Fiberglass piping supports spacing shall be in accordance with the manufactures guidelines.

2.8 VIBRATION ISOLATION HANGERS

A. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

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1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. .

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles on all piping with roller hangers installed outside of insulation. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier not on roller hangers. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

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4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 2 and Larger: Include reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply cold galvanizing-repair paint to comply with ASTM A 780. ZRC cold galvanizing compound

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports or metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

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5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

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O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.7 MISCELLANEOUS:

A. Equipment bases and supports.
   1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Champers edges all four side. Provide dowels into concrete floor for equipment that is seismically braced.
   2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment. Provide for all equipment, pumps, air handling units, etc.
   3. Construct supports of steel members. Brace and fasten with flanges bolted to structure. Provide rigid anchors for pipes after vibration isolation components are installed.

B. Flashing;
   1. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
   2. Flash piping projecting above finished roof surface with prefabricated steel reinforced boot and counter flashing sleeve.

C. Sleeves;
   1. Sleeves are required for all piping passing through walls and/or slabs. Sleeve diameter to be large enough to accommodate insulated piping.
   2. Sleeves through interior non-fire rated walls are to have annular space between pipe and sleeve filled with materials specified in Division 1.
   3. Sleeves thru fire rated walls to have annular space filled with fire stopping wrapping strips and expanding caulking applied with a caulking gun for a minimum depth of 3” or in another manner suitable for the application as recommended by the manufacturer. See Division 1.

D. Escutcheons:
   1. Provide escutcheons on all wall pipe penetrations that are visible outside MER spaces. All escutcheons shall be chrome plated.

END OF SECTION 230529

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SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING EQUIPMENT

PART 1 GENERAL

1.1 WORK INCLUDED

A. Identification of mechanical products installed under Division 23.

1.2 REFERENCES

A. ASME A13.1 – Scheme for the Identification of Piping Systems

1.3 SUBMITTALS

A. Submittals as per contract requirements.

B. See Division 1 list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

F. Valve Tag chart.

PART 2 PRODUCTS

2.1 NAMEPLATES, TAGS, MARKERS, ETC

A. Manufacturer: W.H. Brady Co., Signmark Div

B. Acceptable manufacturers offering equivalent products

1. Atlantic Engraving Company.
2. Seton Name Plate Co.
3. MSI Services
4. Substitutions as per Contract Requirements.

C. Description: Nameplates should be as specified in Division 1.

PART 3 EXECUTION

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3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials

B. Prepare surfaces in accordance with contract requirements.

3.2 INSTALLATION

A. Install tags, markers, etc. in conformance with Division 1.

B. Unless otherwise specified, color shall conform with ANSI/ASME A13.1

C. Install identifying devices after completion of coverings and painting.

D. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

E. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished cloth covering, apply paint primer before applying labels.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Apply stencil painting in accordance with contract requirements.

H. Identify all equipment, including pumps, air handlers, air cooled condensers, boilers, pumps, packaged AC units, and hot water heater with nameplates. Small devices, such as in-line pumps, may be identified with metal tags. Identify service of all air handling units, ac units split and packaged units. I.E. Ground floor offices.

I. Identify control panels and major control components outside panels with nameplates.

J. Identify valves in main and branch piping with brass tags. Main shutoff valves for boilers shall be furnished with special wording as required by ASME IV HG 710.5 "Supply or Return Valve No. X - Do Not Close Without Also Closing Supply or Return Valve No. Y".

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with markers. Use tags on piping 3/4 inch diameter and smaller. Identify <u>service,</u> <u>flow direction,</u> and <u>pressure</u>. Install in clear view and align with axis of piping. 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. Labeling shall be in conformance with OSHA and ANSI A13.1.

M. Identify all ductwork every 20’ with flow arrows and unit or air handler served as well as service, such as SUPPLY AIR, RETURN AIR, EXHAUST AIR. Etc

N. All smoke purge system components (including supply and exhaust ductwork) shall be

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clearly identified as such by stenciling the function and zone on the components, e.g. Smoke Purge Supply - Zone 2; Smoke Purge Exhaust - Zone 3; Smoke Damper No. 5; etc. Stenciling shall be 6" high red letters located (every 10 feet along duct).

O. Identify all Smoke Dampers and Fire Dampers. All dampers shall be sequentially numbered by floor. For example fire damper - FD-1-1 (Fire damper #1, floor 1) Tag shall be 1" high red letters located on damper. Provide red dot stencil on ceiling below damper.

P. Provide permanent labels for all controls and limits which state function of each control and control set-points.

Q Provide tags for the following; **and** including but not limited to the following;
- Hydronic systems
- Cold water make up

3.3 SCHEDULE

A. Provide valve chart and schedule minimum of 8.5” x 11” in aluminum frame with clear laminate face. Install in the boiler room or at location as directed by the facilities. Indicate Valve #, size, Service and N.O. or N.C.

VALVE TAG SCHEDULE			
No.	size	Service	N.O./N.C.

END OF SECTION

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems:

    a. Constant-flow hydronic systems.

3. Balancing steam systems.
4. Testing, Adjusting, and Balancing Equipment:
    a. Motors.
    b. Condensing units.
    c. Boilers.

5. Testing, adjusting, and balancing existing systems and equipment.
6. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

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1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the engineer, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Certified TAB reports.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.7 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

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1.8 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

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H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.

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j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning per the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR ALL SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

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C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

M. Code requirements;

Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the NYS Mechanical Code. Discharge dampers used for air-system balancing are prohibited on constant-volume fans and variable volume fans with motors 10 hp and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

   a. Measure static pressure directly at the fan outlet or through the flexible connection.

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b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 GENERAL PROCEDURES FOR ALL HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

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B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

D. Code requirements;

1. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed **or** pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have the capability to measure pressure across the pumps, and test ports at each side of each pump.

2. For systems 10 Hp and over, where throttle or balance valves are used on the discharge side of pumps balancing shall be performed by adjusting pumps speed at the variable frequency drive. The balance or throttle valves shall be used for positive shut off and as a means of reading flow across the ports.

3. Flow shall be balanced to total gpm given in the schedule for the pump and branch gpm as given on plan. Total dynamic head, (TDH), given in the plans and schedule or specifications is an estimate. The system shall be balanced such that the required flow is achieved by adjusting pump speed and branch balancing valves as well as terminal unit balancing valves. Upon balancing the actual required TDH can be established. This shall be used as the design set point used to modulate pump speed.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.

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c. Convert pressure to head and correct for differences in gage heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set.

3.8 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

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2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.10 PROCEDURES FOR BOILERS

A. Hydronic Boilers:

1. Measure and record entering- and leaving-water temperatures.
2. Measure and record water flow.
3. Record relief valve pressure setting.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

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3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

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1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.

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c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Cooling-coil static-pressure differential in inches wg.
g. Heating-coil static-pressure differential in inches wg.
h. Outdoor airflow in cfm.
i. Return airflow in cfm.
j. Outdoor-air damper position.
k. Return-air damper position.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.

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l. Motor full-load amperage and service factor.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Low-fire fuel input in Btu/h.
f. High-fire fuel input in Btu/h.
g. Manifold pressure in psig.
h. High-temperature-limit setting in deg F.
i. Motor voltage at each connection.
j. Motor amperage for each phase.
k. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

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1. Report Data:

   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated airflow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual airflow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Number from system diagram.
   f. Size.

2. Test Data (Indicated and Actual Values):
   a. Final airflow rate in cfm.
   b. Final velocity in fpm.

J. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model number and serial number.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Pump rpm.
   i. Impeller diameter in inches.
   j. Motor make and frame size.
   k. Motor horsepower and rpm.
   l. Voltage at each connection.
   m. Amperage for each phase.
   n. Full-load amperage and service factor.

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2. Test Data (Indicated and Actual Values):

   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.

K. Instrument Calibration Reports:

1. Report Data:

   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

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2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

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SECTION 23 07 13 HVAC DUCTWORK INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ductwork insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 RELATED SECTIONS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.

B. Section 23 31 13 - Ductwork.

1.03 REFERENCES

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NAIMA National Insulation Standards.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

H. ASHRAE 90-75 – Insulation Standards

1.04 SUBMITTALS

A. Division 1 - Submittals: Procedures for submittals.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Submit manufacturers' insulation instructions under provisions of Division 1.

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1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience approved by manufacturer.

1.06 REGULATORY REQUIREMENTS

A. Materials: Flame spread/fuel contributed/smoke developed rating of 25/50/50 in accordance with NFPA 255.

B. Insulation thickness shall comply with all applicable energy conservation codes.

1.07 ENVIRONMENTAL REQUIREMENTS

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

2.01 ACCEPTABLE MANUFACTURERS - INSULATION

A. Owen Corning Fiberglass Corp.

B. Manville Industrial Products

C. Certain Teed Corporation

D. 3M Corporation “Firemaster” for Kitchen Exhaust

E. Substitutions: Under provisions of Division 1.

2.02 GLASS FIBER, RIGID

A. Type A: Flexible glass fiber duct insulation; ANSI/ASTM C612; commercial grade; “K” value of 0.25 at 75º F; minimum density of 1-1/2 pounds per cu. ft.; factory applied vapor barrier jacket of 0.7 mil minimum aluminum foil laminated to glass fiber reinforced Kraft paper. Similar to Owens-Corning type FRK-25-ED Type 150 commercial grade.

B. Type B: Rigid glass fiber board insulation with resin binder; ANSI/ASTM C612, Class 1; “K” value of 0.23 at 75º F minimum density of 6 pounds per cu. ft; factory applied white Kraft faced flame retardant vapor barrier jacket of aluminum laminated to heavy Kraft paper with a flame retardant snuffer type adhesive and reinforced with glass fibers; permeability of 0.2. Similar to Owens-Corning type 705 with AST jacket.

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C. Type C: Molded block or board insulation made of asbestos free hydrous calcium silicate; "K" value of 0.42 at 200º F; minimum density of 14 pounds per cubic foot; temperature range up to 1200º F.

D. Type D1: **Flexible Glass Duct Liner: (For standard applications)**

ANSI/ASTM C553; "K" value of 0.23 at 75º F; minimum density of 1.5 pounds per cu. ft.; surface finish of black pigmented fire resistant resilient mastic coated on air side for maximum velocity of 4000 feet per minute.

a. Maximum Thermal Conductivity

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

b. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

c. Solvent Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

E Type D2: **Flexible Elastomeric Duct Liner: (Wet or Damp Applications Including Natatorium and Saunas and for all procedure, and medical facilities**).

Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

F. Type "E" – Fire resistant duct wrap consisting of light weight, non-asbestos high temperature non-organic ceramic fiber blanket encapsulated in foil/scrim having a service temperature rating of 2300º F. Wrap shall be applied in two temperature layers to provide a two-hour rated enclosure assembly. Bonding material shall be 304 stainless steel, ¾" wide and .015" thick.

G Adhesives: Waterproof fire-retardant type. Smoke and flame spread rating less then 50.

H. Indoor Jacket: Pre-sized glass cloth, minimum 7.8 oz/sq. yd unless otherwise specified above.

I. Outdoor Jackets: All exterior ductwork shall be jacketed as per the specification and jacket with Alumaguard Cool Wrap by Polyguard. For watertight insulation jacket install as per manufacturers recommendations. Furnish all mastics and adhesives as per manufacture system.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Install insulation materials only after ductwork has been sealed, tested and approved.

B. All insulated surfaces are to be cleaned and dried of any foreign material. This includes but is not limited to oil, water, dirt, rust and scale. Completely cover the entire surface to present a tight, smooth appearance.

3.02 INSTALLATION

A. Division 1 - Quality Control: Install materials in accordance with manufacturer's instructions, specification requirements and in compliance with local code

B. Install in accordance with NAIMA National Insulation Standards.

C. Apply insulation in such a way as to permit expansion and/or contraction of metal without causing damage to insulation, joints, seams or finish.

D. Do not apply additional coats of mastic, adhesive, or sealers until previous coats have thoroughly dried.

E. Fill in all surface imperfections such as chipped edges, small joints, cracks, holes and small voids with materials o match insulation. Make smooth with a skim coat of insulation cement. Extend surface finish to protect all surfaces and leave no exposed edges.

F. Provide flashing for insulation installed outdoors to enclose all exposed edges or ends.

G. Repair existing insulation where damaged by new work. Use materials to match existing.

H. Cut, score or miter insulation to fit the slope and contour of surface to be covered. Insulation up to 3 inches thick to be applied in single layer. Over 3 inches apply in multiple layers, with joints staggered.

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INSULATION APPLICATION SCHEDULE

Service	Type	Insulation Thickness
[1]Interior H&V, AC systems; SA, RA & EA, ductwork that is exposed in equip rooms.	B	1-1/2"
[1]Interior H&V, AC systems; SA, RA & EA including flexible run outs, that is concealed.	A	2"
Outside air intake ductwork All	B	1 1/2"
[2]Exterior H&V, AC systems; SA, RA & RA, ductwork that that is exposed outdoors.	B	2”
Acoustically line all SA & RA ductwork For a distance of 15’ from fan inlet and outlet	D1	1/2”
[5]Interior exposed H&V, AC systems; SA, RA rectangular, spiral round or oval ductwork;		
Located in conditioned space	D1	1 "
Located in unconditioned space, plenum or equipment room.	D1	11/2”
Kitchen hood exhaust (grease duct)	E	2” applied in (2) 1” layers.

1. Reduce external insulation to 1” for internally lined ductwork except for outdoor installations. On outdoor installations insulation thickness shall be as scheduled but not less than the height of standing seams or angle bracing.
2. Insulation Thickness shall be no less than the size indicated or the height of standing seams or angle bracing.
3. Outside air intake and Kitchen exhaust ducts shall not be internally lined.
4. Smoke purge system supply and exhaust ducts passing through a rated Exit-way or within a fire-rated suspended ceiling assembly and all Kitchen Hood exhaust ducts shall be wrapped with thermal fiber - two (2) hour or encased in a two (2) hour rated enclosure. Trapeze hangers to be outside of thermal wrapping.
5. All square or rectangular ductwork that is exposed to view in finished spaces shall be internally insulated.
6. All exterior ductwork shall be insulated and jacketed.

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END OF SECTION

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SECTION 23 07 19 HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation

B. Jackets and accessories

1.02 RELATED SECTIONS

A. Section 23 05 53 – Identification for HVAC Piping and Equipment.

B. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCES

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

C. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

D. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

F. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

H. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation

I. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

K. NAIMA National Insulation Standards

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L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

N. ASHRAE 90-75 - Insulation Standards

1.04 SUBMITTALS FOR REVIEW

A. Division 1 – Submittal Requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with NFPA 255

B. Insulation thickness shall comply with applicable Energy Conservation Codes.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Pittsburgh Corning Corporation

B. Certainteed Corporation.

C. Armstrong Corporation.

D. Manville Industrial Products.

E. Owens-Corning Fiberglass Corporation

F. Polyguard

2.02 INSULATION

A. Type A: Molded glass fiber insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75º F; noncombustible. Minimum density of 3.5 lbs./cu. Ft.; temperature range 35º F to 450º F.

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B. Type B: Cellular glass insulation; ASTM C552; 'K' Value of 0.53 at 75°F; non-combustible. Minimum density of 8.0 lbs./cu. ft. similar to Pittsburgh Corning Foamglas.

C. Type C: Elastomeric insulation; ASTM C518, C177; 'K' Value of 0.27 at 75°F; non-combustible. Similar to Armstrong "AP Armaflex"; temperature range -40º F to 220º F

D. Type D; Underground engineered pipe insulation system shall be as follows;
Service pipe insulation shall be spray applied .16k-factor, R141B blowing agent, nominal 2 pound per cubic foot density, polyurethane foam for straight sections and preformed polyurethane foam for all fittings. Insulation shall not be less then 2" and shall be Perma-pipe polytherm.

2.03 JACKETS

A. Interior Applications:

1. Insulation Type A - Factory applied, white, flame retardant, all service (ASJ) vapor barrier jacket of .001" aluminum foil laminated to Kraft paper with a flame retardant snuffer type adhesive reinforced with glass fibers and having a self sealing lap. Provide 2" longitudinal lap and 4" circumferential sealing strips. Permeability .02 perm.

B. Exterior Applications:

1. Insulation Type A thickness as scheduled with ASJ vapor barrior jacket - Cover factory interior jacket with Alumaguard Cool Wrap by Polyguard, rubberized bitumen membrane designed specifically to be installed over insulation on exterior piping, tanks, vessels, and equipment. The membrane shall be 'peel and stick', self-healing if punctured, UV stable, and will expand and contract with the mechanical system. All seams shall be sealed water tight. Permeability .0053 perm

C. Piping exposed in occupied spaces:

1. All exposed piping and fittings shall be completely covered with white Zeston 2000 PVC insulated piping and fitting covers. Apply as per manufacturer with perma weld adhesive.

2.04 ACCESSORIES

A. Insulation Bands: ¾" wide; 0.007 inch thick aluminum.

B. Metal Jacket Bands: 3/8" wide; 0.015 inch thick aluminum.

C. Insulating Cement: ANSI/ASTM C195; hydraulic setting mineral wool.

D. Finishing Cement: ASTM C449

E. Fibrous Glass Cloth: Untreated; 9 oz/sq. yd weight.

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F. Adhesives: Compatible with insulation and fire retardant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with all foreign material removed. This includes but is not limited to water, oil, dirt, scale and rust.

D. Only insulation and finish materials including adhesive cements and mastic which conform to the requirements of all-governing codes and ordinances shall be used.

3.2 INSTALLATION

A. Division 1 – Quality Control: Install materials in accordance with manufacturer's instructions and the best practice of the trade.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulation on all piping shall be vapor sealed. On insulated piping with vapor barrier, insulate all fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Vapor seal all exposed edges with jacket material and vapor barrier type adhesive.

D. Repair or replace any existing insulation and surface finish disturbed or damaged by installation of new work using materials to match existing.

E. Apply insulation to completely cover metal surface. Surface shall be applied to present a tight, smooth appearance.

F. Exposed Piping: Locate insulation and cover seams in least visible locations.

G. For hot piping conveying fluids 140 degrees F or less, and on insulated piping without vapor barrier, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

I. Neatly finish insulation at supports, protrusions, and interruptions.

J. Do not use staples on vapor barrier insulation.

K. Jackets:

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1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with vapor barrier, factory-applied or field-applied. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass cloth and adhesive. PVC jackets may be used
2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with glass cloth and vapor barrier adhesive.
3. Indoor, Exposed Applications: For pipe exposed in mechanical equipment rooms or in finished spaces, insulate and jacket as for concealed applications, and finish with PVC jackets.
4. Outdoor Applications: Cover factory interior jacket with Alumaguard Cool Wrap by Polyguard, rubberized bitumen membrane designed specifically to be installed over insulation on exterior piping, tanks, vessels, and equipment. The membrane shall be 'peel and stick', self-healing if punctured, UV stable, and will expand and contract with the mechanical system. All seams shall be sealed water tight. Permeability .0053 perm

L. Inserts and Shields:

1. Application: All insulated Piping 2 inches diameter or larger shall be installed with inserts and shields as follows.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

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2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

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C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations for valves of fitting that require service..

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3.5 INSULATION SCHEDULE

Refer to the insulation schedule below for pipe insulation thickness by system. Not all systems are necessarily included in this project

INSULATION SCHEDULE							
SERVICE	INSULATION TYPE	TEMPERATURE RANGE (F°)	NOMINAL PIPE SIZE				
			<1"	1" to< 1 1/2"	1 1/2" to< 4"	4" to< 8"	≥ 8"
			INSULATION THICKNESS				
Hot Water (HW)	A	> 350°	4 1/2	5	5	5	5
		251°-350°	3	4	4	4 1/2	4 1/2
		201°-250°	2 1/2	2 1/2	2 1/2	3	3
		141°-200°	1 1/2	1 1/2	2	2	2
		105°-140°	1	1	1 1/2	1 1/2	1 1/2
Buried (HW)	C	> 350°	4 1/2	5	5	5	5
		251°-350°	3	4	4	4 1/2	4 1/2
		201°-250°	2 1/2	2 1/2	2 1/2	3	3
		141°-200°	2	2	2 1/2	2 1/2	2 1/2
		105°-140°	1 1/2	1 1/2	2	2	2
Chilled Water (CHW)	A	40°- 60°	1/2	1/2	1	1	1
		< 40°	1/2	1	1	1	1
Buried (CHW)	C	40°- 60°	1	1 1/2	1 1/2	1 1/2	1 1/2
		< 40°	1	1 1/2	1 1/2	1 1/2	1 1/2
Steam & Condensate	A	Low Pressure	2 1/2	2 1/2	2 1/2	3	3
Steam Condensate	A	Low Pressure	2 1/2	2 1/2	2 1/2	3	3
Condensate Drains	A	All	1/2	1/2	1	1	1
Cold Water Make up	A	All	1/2	1/2	1	1	1
Refrigerant Hot Gas	C	All	1 1/2	1 1/2	2	2	2
Humidifier Steam	A	All	2 1/2	2 1/2	2 1/2	3	3
Refrigerant Suction	C	All	1/2	1/2	1	1	1

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END OF SECTION

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SECTION 230923.16 - GAS INSTRUMENTS

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 the Following Gas Instruments:

1. Carbon-monoxide sensors and transmitters. CO
2. Nitrogen-dioxide sensors and transmitters. NO2
3. VOC sensors and transmitters.
4. Multipoint monitoring system.

1.3 DEFINITIONS

A. NDIR: Nondispersive infrared.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Installation instructions, including factor affecting performance.
3. Product description with complete technical data, performance curves, product specification sheets.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include diagrams for power, signal, and control wiring.
3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

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1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which wall-mounted instruments located in finished space are shown and coordinated with each other, showing relationship to light switches, fire alarm devices, and other installed devices using input from installers of the items involved.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas instruments to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 CARBON-MONOXIDE AND NITROGEN DIOXIDE SENSORS AND TRANSMITTERS

A. Manufactures
1. Sierra monitoring and controls
2. Honeywell analytical
3. Armstrong Monitoring

B. Description:

1. NDIR technology or equivalent technology providing long-term stability and reliability.
2. Two-wire, 4-20 mA output signal, linearized to gas concentration in ppm.

C. Construction:

1. House electronics in an ABS plastic enclosure. Provide equivalent of NEMA 250, Type 1 enclosure for wall-mounted space applications and NEMA 250, Type 4 for duct-mounted applications.
2. Equip with digital display for continuous indication of gas concentration.

D. Performance:

1. Measurement Range: Zero to 2000 ppm.
2. Accuracy: Within 2 percent of reading, plus or minus 30 ppm.
3. Repeatability: Within 1 percent of full scale.
4. Temperature Dependence: Within 0.05 percent of full scale over an operating range of 25 to 110 deg F
5. Long-Term Stability: Within 5 percent of full scale after more than five years.
6. Response Time: Within 60 seconds.
7. Warm-up Time: Within five minutes.

E. Provide calibration kit. Turn over to Owner at start of warranty period.

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2.2 COMBINATION CARBON-DIOXIDE AND VOC SENSORS AND TRANSMITTERS (NOT USED)

A. Description:

1. NDIR technology or equivalent technology that provides long-term stability and reliability.
2. Senses and responds to combined concentration of more than 30 contaminates commonly found in indoor environments.

B. Output Signal: Zero to 10-V dc.

C. Performance:

1. Carbon-Dioxide Range: Zero to 2000 ppm.
2. Carbon-Dioxide Accuracy: Within 50 ppm, plus 2 percent measured value.
3. VOC Range: Zero to 2000 ppm.
4. VOC Sensitivity Ranges: Field selectable, low, normal, high.
5. Ambient Temperature: 32 to 122 degrees F.
6. Ambient Relative Humidity: 5 to 95 percent non-condensing.

D. Enclosure: White plastic.

E. Electrical Connections: Screw terminals.

F. Display: Digital, LCD.

2.3 MULTIPOINT CARBON-MONOXIDE AND NITROGEN DIOXIDE MONITORING SYSTEM

A. Manufactures
1. Sierra monitoring and controls
2. Honeywell analytical
3. Armstrong Monitoring

B. Description:

1. Each sampling point shall monitor any variation in the carbon-monoxide concentration level.
2. Each sampling point shall be individually piped to the monitoring system.
3. Provide each sampling point with a 0.3-micron filter.
4. Each sampling point shall be an alarm point.
5. A dual-head diaphragm pump shall draw an air sample through piping system and through a microprocessor-controlled sequencer feeding an analyzer with a new sample every 15 seconds.
6. Sample time shall be adjustable in 1 second increments from zero to 60 minutes.
7. Span and zero calibration gas shall be automatically initiated by the microprocessor. System shall also provide manual initiation of span and zero calibration gas.

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8. Analyzer output shall be corrected by the microprocessor.
9. Monitoring system shall have 32 sample points.
10. System shall operate on 120-V ac, single-phase, 60-Hz power.
11. Final adjustment; calibration, testing, and startup of the system shall be performed by a trained representative of manufacturer.

C. Analyzer:

1. Analyzer shall operate using principle of nondispersive infrared absorption.
2. Sampling response time shall be within 10 seconds.
3. Zero drift and span drift shall be less than 1 percent of full scale within a 24-hour period.
4. Repeatability shall be within 1 percent of full scale.
5. Accuracy shall be within 1 percent of full scale.
6. Calibration range shall be zero to 500 ppm.
7. Digital display on analyzer face with scale shall be in ppm.
8. Temperature shall be compensated from 30 to 120 deg F ambient temperature.

D. Control and Display:

1. Each sample shall send a 4-20 mA output signal proportional to the highest concentration.
2. Alphanumeric visual display of current analyzer concentration reading shall be in ppm or another industry-accepted measurement.
3. Visual indication for sample analyzing, sample high-concentration alarm, analyzer malfunction, and calibration.
4. Any number and configuration of sample points shall be capable of being bypassed.
5. Each sample point shall be capable of being manually sampled through an override feature.
6. System parameters shall be stored in nonvolatile memory.
7. Provide at least an eight-hour battery backup of current alarm status. Battery shall be rechargeable.

E. Enclosure:

1. NEMA 250, Type 1 or Type 12.
2. Hinged and locking door, full size of face.
3. House all system components. Multiple adjoining enclosures are acceptable if joined to a common support structure.

F. Calibration Equipment:

1. Provide equipment necessary to automatically and manually calibrate the system, including, but not be limited to, the following:

   a. Regular assembly.
   b. Zero cap.
   c. Calibration cap.
   d. Two cylinders filled with calibration gas.
   e. Instruction book.

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f. Carrying case.

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. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to seismic loads.

D. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by using excessive force or oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

F. Corrosive Environments:

1. Use products that are suitable for environment to which they are subjected.
2. If possible, avoid or limit use of materials in corrosive environments, including but not limited to, the following:

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a. Laboratory exhaust airstreams.
b. Process exhaust airstreams.

3. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
4. Where instruments are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

G. PROTECTION
1. Provide steel protection guards for all sensors located in the garage area. Guards are to factor, or field fabricated out of heavy gauge galvanized steel

3.3 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.4 INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:

1. Install transmitters for gas associated with individual air-handling units and associated connected ductwork and piping near air-handlings units co-located in air-handling unit system control panel, to provide service personnel a single and convenient location for inspection and service.
2. Install space sensors in location where they are least likely to be damaged. Plans indicate general locations. Final locations shall be coordinated in the field with other trades. In general, where located in traffic areas install on the back of columns where damage is least likely.
3. Install gas switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
4. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

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5. Install instruments in dry gas and non-condensable vapor piped services above their process connection point. Slope process connection lines up to instrument with a minimum slope of 2 percent.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

   a. Make every effort to mount at 60 inches.

C. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated, using neoprene gaskets or grommets.

3.5 CARBON-MONOXIDE and NITROGEN DIOXIDE MONITORING SYSTEM

A. Install sample points in monitored area to provide accurate measurement of gas concentration.

B. Install exposed sampling points with a finished appearance consistent with other materials in space. Submit proposed products to be installed for review and approval.

C. Individually install each sample point to the carbon-monoxide monitoring system.

D. Install tubing in a minimum size of NPS 3/8.

E. Use compression fittings at connections to equipment.

F. If not indicated on Drawings, locate carbon-monoxide monitoring system in a secured and serviceable location accessible to authorized personnel.

G. Support carbon-monoxide monitoring system from floor or wall. Support floor-mounted systems using a structural channel frame. Provide mounting brackets.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 23 05 53 "Identification for HVAC Systems."

B. Install engraved phenolic nameplate with instrument identification on face.

3.7 CHECKOUT PROCEDURES

A. Check out installed products before continuity tests, leak tests, and calibration.

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B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

3.8 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, perform a three-point calibration test for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written recommendations.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures in ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

E. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

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F. Switches: Calibrate switches to make or break contact at set points indicated.

G. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.9 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of gas system and equipment Installer. Include annual preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.10 DEMONSTRATION

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

B. Coordinate gas instrument demonstration video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

3.11 SEQUENCE OF OPERATION

Gas detection: There shall be two zones of CO and NO2 detection in the building. Refer to the floor plans. There shall be two levels of gas detection for each of the zones. The following shall be the sequence.

Normal Operation;
GS-2 runs at 25% or 500 cfm. O.A.I damper open
GX -2 runs at 50% or 1,000 cfm. Relief air damper open

Level 1 – Zone 1 detection - 25ppm CO, 50ppm NO2.
GS-1 runs at 50% or 1,000 cfm. O.A.I. damper open
GX -1 runs at 50% or 1,000 cfm. Relief air damper open

Level 2 – Zone 1 detection - 50ppm CO, 100ppm NO2.
GS-1 runs at 100% or 2,000 cfm. O.A.I. damper open
GX -1 runs at 100% or 2,000 cfm. Relief air damper open

Level 1 – Zone 2 detection - 25ppm CO, 50ppm NO2.
GS-2 runs at 50% or 1,000 cfm. O.A.I. damper open
GX -2 runs at 50% or 1,000 cfm. Relief air damper open

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Level 2 – Zone 2 detection - 50ppm CO, 100ppm NO2.
GS-2 runs at 100% or 2,000 cfm. O.A.I. damper open
GX -2 runs at 100% or 2,000 cfm. Relief air damper open

END OF SECTION 230923.16

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SECTION 232113 - HYDRONIC 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 pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.
2. Pressure-seal fittings.
3. Chemical treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

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1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Makeup-Water Piping: 80 psig at 150 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Air-Vent Piping: 200 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Copper or Bronze Pressure-Seal Fittings:

1. Basis of design; Viega LLC

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Products Corporation.

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b. Mueller Industries, Inc.
c. NIBCO INC.

3. Housing: Copper.
4. O-Rings and Pipe Stops: EPDM.
5. Tools: Manufacturer's special tools.
6. Minimum 200-psig working-pressure rating at 250 deg F.

E. Wrought-Copper Unions: ASME B16.22.

2.3 PLASTIC PIPE AND FITTINGS (CONDENSATE DRAINS FROM CONDENSING BOILERS AND HEATERS AND AIR CONDITIONING CONDENSATE DRAINS ONLY).

A. CPVC Plastic Pipe: ASTM F 441/F 441M, with wall thickness as indicated in "Piping Applications" Article.

1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

B. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.

1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.4 JOINING MATERIALS

A. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.

a. CPVC solvent cement shall have a VOC content of 490 g/L or less.
b. Adhesive primer shall have a VOC content of 550 g/L or less.
c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of

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Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

   a. PVC solvent cement shall have a VOC content of 510 g/L or less.
   b. Adhesive primer shall have a VOC content of 550 g/L or less.
   c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
   1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:
   1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 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. Description:

      a. Standard: ASSE 1079.
      b. Pressure Rating: 150 psig 250 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Description:

      a. Standard: ASSE 1079.
      b. Factory-fabricated, bolted, companion-flange assembly.
      c. Pressure Rating: 150 psig minimum at 250 deg F.
      d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
   1. Description:

      a. Nonconducting materials for field assembly of companion flanges.

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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 Nipples:
1. Description:

a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

2.7 BYPASS CHEMICAL FEEDER

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. **Hot-water heating, Piping aboveground**; **All,** shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, pressure-seal joints.
2. Schedule 40, Grade B, Type 96 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Makeup-water piping installed aboveground shall be either of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

C. Condensate-Drain Piping: Type M, Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

D. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

F. Air-Vent Piping:

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1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains usingtee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

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P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install shutoff valve immediately upstream of each dielectric fitting.

R. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

S. 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."

T. 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."

U. Install escutcheons on all exposed piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230517 "Sleeves and Escutcheons for HVAC Piping."

V. Install packless expansion fitting in all hydronic piping sections that are 75’ long or over.

3.3 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 nipples, or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, or nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports and hanger rod size.

B.]Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

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6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 6 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. 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.

D. 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/A5.8M.

E. 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.

F. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

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3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

G. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

H. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum of 100 ppm. Revise this value if closed system contains glycol.
5. Corrosion Inhibitor:

    a. Sodium Nitrate: 1000 to 1500 ppm.
    b. Molybdate: 200 to 300 ppm.
    c. Chromate: 200 to 300 ppm.
    d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    e. Chromate Plus Molybdate: 50 to 100 ppm each.

6. Soluble Copper: Maximum of 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum of 10 ppm.
8. Total Suspended Solids: Maximum of 10 ppm.
9. Ammonia: Maximum of 20 ppm.
10. Free Caustic Alkalinity: Maximum of 20 ppm.

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11. Microbiological Limits:

    a. Total Aerobic Plate Count: Maximum of 1000 organisms/mL.
    b. Total Anaerobic Plate Count: Maximum of 100 organisms/mL.
    c. Nitrate Reducers: 100 organisms/mL.
    d. Sulfate Reducers: Maximum of zero organisms/mL.
    e. Iron Bacteria: Maximum of zero organisms/mL.

B. Install bypass chemical feeders in each hydronic system where indicated.

1. Install in upright position with top of funnel not more than 48 inches above the floor.
2. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

D. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure rating for any vessel, pump, valve, or other component in system under test.

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5. After hydrostatic test pressure has been applied for at least 30 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing. Submit for engineers approval.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers,

END OF SECTION 232113

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SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.
4. Blowdown-drain piping.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.
7. Expansion fittings for hydronic piping
8. Pipe guides and anchors

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

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1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: **150** psig at **200 deg F**
2. Makeup-Water Piping: **80 psig** at **150 deg F**
3. Condensate-Drain Piping: **150 deg F**.
4. Blowdown-Drain Piping: **200 deg F**
5. Air-Vent Piping: **200 deg F** .
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523.10 "Valves for HVAC Piping,"

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230923.11 "Control Valves."Section 15901 "Control Valves."

2.3 Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett; a Xylem brand.
c. Nexus Valve, Inc.
d. TACO Comfort Solutions, Inc.
e. Tour & Andersson; available through Victaulic Company.
f. Victaulic Company.

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2. Body: Bronze, ball or globe type with calibrated orifice or venturi.

3. Ball: Brass or stainless steel.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum **125 psig**
9. Maximum Operating Temperature: 250 deg F

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett; a Xylem brand.
   c. Nexus Valve, Inc.
   d. Tour & Andersson; available through Victaulic Company.

2. Body: Cast-iron or steel body, globe pattern with calibrated orifice or venturi.

3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum **125 psig**
11. Maximum Operating Temperature: 250 deg F

C. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Spence Engineering Company, Inc.
   e. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.

3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.

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8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Spence Engineering Company, Inc.
   e. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.

3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flow Design, Inc.
   b. Griswold Controls.
   c. Nexus Valve, Inc.
   d. NuTech Hydronic Specialty Products.

2. Body: Brass or ferrous metal.

3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: **175 psig**
9. Maximum Operating Temperature: **200 deg F**

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2.4 AIR-CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. TACO Comfort Solutions, Inc.
   e. John Wood

B. Manual Air Vents:

   1. Body: Bronze.

   2. Internal Parts: Nonferrous.
   3. Operator: Screwdriver or thumbscrew.
   4. Inlet Connection: NPS 1/2
   5. Discharge Connection: NPS 1/8.
   6. CWP Rating: 150 psig
   7. Maximum Operating Temperature: 225 deg F

C. Automatic Air Vents:
   1. Body: Bronze or cast iron.
   2. Internal Parts: Nonferrous.
   3. Operator: Noncorrosive metal float.
   4. Inlet Connection: NPS 1/2
   5. Discharge Connection: NPS 1/4
   6. CWP Rating: 150 psig
   7. Maximum Operating Temperature: 240 deg F

D. Expansion Tanks:
   1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

   2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for **125-psig** working pressure and **250 deg F** maximum operating temperature.
   3. Tank Drain Fitting: Brass body, nonferrous internal parts; **125-psig** working pressure and **240 deg F** maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
   4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

E. Diaphragm or Bladder-Type Expansion Tanks as scheduled or noted on plans:

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1. Tank: Welded steel, rated for **125-psig** working pressure and **375 deg F** maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Diaphragm or Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Tangential-Type Air Separators:
1. Tank: Welded steel; ASME constructed and labeled for **125-psig** minimum working pressure and **375 deg F** maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for **NPS 2** and smaller; flanged connections for **NPS 2-1/2** and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

G. In-Line Air Separators:
1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to **175 psig**
3. Maximum Operating Temperature: Up to **300 deg F**

H. Air Purgers:
1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: **150 psig**
3. Maximum Operating Temperature: **250 deg F**

2.5 HYDRONIC PIPING SPECIALTIES

A. 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: **125 psig**

B. 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: **125 psig**

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C. 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**

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: **150 psig**
5. Maximum Operating Temperature: 250 deg F

E. Braided Pipe Flexible Connection;

1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3"and larger shall be flanged. Smaller sizes may have male nipples. Minimum sizes listed below.

Flanged (Pipe Dia x Flexible Pipe Length)		
3" x 12"	6" x 18"	12" x 24"
4" x 12"	8" x 18"	14" x 30"
5" x 18"	10" x 18"	16" x 32"

Male Nipples (Pipe Dia x Flexible Pipe Length)		
1/2" x 12"	1-1/4" x 12"	2" x 12"
3/4" x 12"	1-1/2"x 12"	2-1/2" x 18"
1" x 12"		

2. At equipment connections, hoses shall be installed on the equipment side of the shut-off valves horizontal and parallel to the equipment shafts wherever possible. Hoses shall be type FFL or type MN as manufactured by Mason Industries, Inc

F. Vibration isolation pipe hangers; pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

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2.6 PACKLESS EXPANSION JOINTS

A. Metal, Compensator Packless Expansion Joints: Metraflex Model HPFF – for copper, Model HP for steel pipe

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flexicraft Industries.
   b. Mason Industries, Inc.
   c. Metraflex Company (The).

2. Minimum Pressure Rating: 150 psig, [**175 psig**] [**200 psig**] unless otherwise indicated.

3. Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.
4. Joint Axial Movement: 2 inches of compression and 1/2 inch of extension.
5. Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.

   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

6. Configuration for Steel Piping: Multi-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Threaded Welded.

2.7 ALIGNMENT GUIDES AND ANCHORS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advanced Thermal Systems, Inc.
   b. Flexicraft Industries.
   c. Mason Industries, Inc.
   d. Metraflex Company (The).

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

3. Steel Shapes and Plates: ASTM A 36/A 36M.
4. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
5. Washers: ASTM F 844, steel, plain, flat washers.
6. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened concrete, with tension and shear capacities appropriate for application. Threaded stud, expansion plug, nuts and washers shall be zink-coated carbon steel.

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7. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened concrete, with tension and shear capacities appropriate for application.

   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
   b. Stud: threaded stud washers and nuts shall be ASTM A 307, zinc-coated carbon steel.
   c. Alignment Guides
      1) Horizontal split spider type guide – Metraflex – Style IV
      2) Slide guide - – Metraflex – model PTFE
      3) Pre-insulated guide – Metraflex – model PG PRE
      4) Vertical glide riser - – Metraflex – model PGQ
   d. Anchors
      1) Anchor clamp – Metraflex – model PA
      2) Structural I Beam Anchors – Metraflex
      3) Pre-insulated Anchor – Metraflex – model PAPI
      4) Modular riser guide – Metraflex – modular riser with EPDM insert

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each manifold and at each branch off the manifold

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

F. All valves and specialties installed in the system shall have a pressure rating that exceeds the system working pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. All valves and specialties installed in the system shall have a pressure rating that exceeds the system working pressure.

B. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

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C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

E. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

F. Install tangential or inline air separator on pump suction side of main piping. Install blowdown piping with full-port ball valve; extend full size to nearest floor drain.

G. Install vibration isolation hangers or supports on all piping connected to motor driven equipment for a distance of 20' or the first two hangers.

H. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

I. Install expansion tanks on the floor. Vent and purge air from hydronic system and **ensure that tank is properly charged with air to suit system Project requirements. System pressure shall be 5psi minimum residual at the top of the system.**

J. Install Packless expansion fittings in all hydronic pipe sections, regardless of service, that is over 75' long straight run. Alternative pipe "expansion loop" may be used if space permits. Piping layout submittal shall indicate guide and ridged mount locations.

3.3 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint or loop not more than three pipe diameters from expansion joint.

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C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
   1. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.
   2. Anchor Attachment to Steel Structural Members: Attach by welding.
   3. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

END OF SECTION 232116

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SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Separately coupled, horizontally mounted, in-line centrifugal pumps.
3. Separately coupled, vertically mounted, in-line centrifugal pumps.
4. Automatic condensate pump units.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

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1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal(s) for each pump.

PART 2 - PRODUCTS

2.1 Manufacturers: Basis of Design: Bell and Gossett

A. Subject to review and approval and compliance with project requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. ITT Corporation.
3. Mepco, LLC.
4. PACO Pumps; Grundfos Pumps Corporation, USA.
5. Patterson Pump Company; a Gorman-Rupp company.
6. Peerless Pump Company.
7. TACO Comfort Solutions, Inc.
8. Thrush Co. Inc.
9. Little Giant

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded or companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: stainless steel
4. Motor shaft; carbon steel.
1. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
2. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
3. Pump Bearings: Oil lubricated; bronze-journal or thrust type.

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C. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

   a. Enclosure: Open, dripproof.
   b. Enclosure Materials: Cast iron or Rolled steel.
   c. Motor Bearings: Permanently lubricated ball bearings up through 5 HP
   d. Motor Bearings Grease lubricated ball bearings over 5 HP.
   e. Unusual Service Conditions:

      1) Ambient Temperature: **40 deg C 104 F.**
      2) Altitude: 100 feet above sea level.
      3) High humidity.

   f. Efficiency: Premium efficient.
   g. NEMA Design: B or C
   h. Service Factor: 1.15.
   i. All motors used with VFDs shall be inverter duty rated

D. Capacities and Characteristics: Refer to plans and schedules.

E. Electrical Characteristics: Refer to plans and schedules.

2.3 SEPARATELY COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze or brass ; statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Carbon Steel
4. Sleeve; Alloy Copper 110.
5. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.)
6. Pump Bearings: permanently Oil lubricated; bronze-journal or thrust type.

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C. Shaft Coupling: Molded-rubber insert with interlocking spider capable of absorbing vibration.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron or Rolled steel.
c. Motor Bearings: Permanently lubricated ball bearings. Upto 5 hp
d. Motor Bearings: Grease-lubricated ball bearings. Over 5 hp
e. Unusual Service Conditions:

1) Ambient Temperature: **40 deg C 104 F.**
2) Altitude: 100 feet above sea level.
3) High humidity.

f. Efficiency: Premium efficient.
g. NEMA Design: B or C
h. Service Factor: **[1.15.]**
i. All motors used with VFDs shall be inverter duty rated

E. Capacities and Characteristics: Refer to plans and schedules.

F. Electrical Characteristics: Refer to plans and schedules.

2.4 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange or union-end connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPT bellows and gasket. Include water slinger on shaft between motor and seal.

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5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Permanently lubricated ball bearings.

C. Shaft Coupling: Axially split spacer coupling.

D. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron or Rolled steel.
c. Motor Bearings: Permanently lubricated ball bearing upto 5 hp
d. Motor Bearings Grease-lubricated ball bearings over 5 hp.
e. Unusual Service Conditions:

1) Ambient Temperature: **40 deg C 104 F.**
2) Altitude: 100 above sea level.
3) High humidity.

f. Efficiency: Premium efficient.
g. NEMA Design: B or C
h. Service Factor: 1.15.
i. All motors used with VFDs shall be inverter duty rated

E. Capacities and Characteristics: Refer to plans and schedules.

F. Electrical Characteristics: Refer to plans and schedules.

2.5 AUTOMATIC CONDENSATE PUMP UNITS

A. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch-minimum, electrical power cord with plug.

B. Capacities and Characteristics: Refer to plans and schedules.

C. Provide condensate overflow switch wired to shut down units

D. Electrical Characteristics: Refer to plans and schedules.

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E. Unit shall be rated for plenum use and piping in plenum ceiling shall be copper. (PVC or hose will not be acceptable)

2.6 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. 175-psig pressure rating, cast or ductile-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

B. Triple-Duty Valve:

1. Angle or straight pattern.
2. 175-psig pressure rating, cast or ductile-iron body, pump-discharge fitting.
3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with ANSI standard HI 1.4 and HI 2.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

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D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to discharge indirectly to an open drain.

E. Equipment Mounting:

1. Install in-line pumps with continuous-thread hanger rods and elastomeric hangers, spring hangers, spring hangers with vertical-limit stop of size required to support weight of in-line pumps as per specification section 23 21 16 Hydronic Piping Specialties .

2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.3 ALIGNMENT

A. Perform pump alignment. For pumps 20 HP or larger engage a factory-authorized service representative to perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 “Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install line size check, shutoff, and balancing valves or triple-duty valve on discharge side of pumps.

F. Install line size Y-type strainer or suction diffuser and shutoff valve on suction side of pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

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H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

I. Install check valve and gate or ball valve on each condensate pump unit discharge.

3.5 STARTUP SERVICE

A. Perform the following startup service;. For motors 20 HP and over engage a factory-authorized service representative to perform the start up.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123

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SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

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1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L – Refer to section 3 for applications

B. ASTM B 280, Type ACR. – Refer to section 3 for applications

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

F. Brazing Filler Metals: AWS A5.8/A5.8M.

G. Flexible Connectors:

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1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

H. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket.
2. End Connections:

   a. NPS 2 and Smaller: With threaded-end connections.
   b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Manufactures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.
   b. Heldon Products; Henry Technologies.
   c. Paul Mueller Company.
   d. Danfoss Inc.
   e. Parker Hannifin Corp.
   f. Keep-Rite Co.

B. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.

2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

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C. Packed-Angle Valves:
   1. Body and Bonnet: Forged brass or cast bronze
   2. Packing: Molded stem, back seating, and replaceable under pressure.
   3. Operator: Rising stem.
   4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
   5. Seal Cap: Forged-brass or valox hex cap.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Working Pressure Rating: 500 psig.
   8. Maximum Operating Temperature: 275 deg F.

D. Check Valves:
   1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
   2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
   3. Piston: Removable polytetrafluoroethylene seat.
   4. Closing Spring: Stainless steel.
   5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Maximum Opening Pressure: 0.50 psig.
   8. Working Pressure Rating: 500 psig.
   9. Maximum Operating Temperature: 275 deg F.

E. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Copper spring.
   5. Working Pressure Rating: 500 psig.

F. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
   1. Body and Bonnet: Plated steel.
   2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
   6. Working Pressure Rating: 400 psig.
   7. Maximum Operating Temperature: 240 deg F.

G. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

   1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.

   2. Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Working Pressure Rating: 400 psig.
   6. Maximum Operating Temperature: 240 deg F.

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H. Thermostatic Expansion Valves: Comply with AHRI 750.
   1. Body, Bonnet, and Seal Cap: Forged brass or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   5. Suction Temperature: 40 deg F.
   6. Superheat: Adjustable or Nonadjustable.
   7. Reverse-flow option (for heat-pump applications).
   8. End Connections: Socket, flare, or threaded union.
   9. Working Pressure Rating: 700 psig.

I. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
   1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   5. Seat: Polytetrafluoroethylene.
   6. Equalizer: Internal or External.
   7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
   8. End Connections: Socket.
   9. Throttling Range: Maximum 5 psig.
   10. Working Pressure Rating: 500 psig.
   11. Maximum Operating Temperature: 240 deg F.

J. Straight-Type Strainers:
   1. Body: Brass or welded steel with corrosion-resistant coating.
   2. Screen: 100-mesh stainless steel.
   3. End Connections: Socket or flare.
   4. Working Pressure Rating: 500 psig.
   5. Maximum Operating Temperature: 275 deg F.

K. Angle-Type Strainers:
   1. Body: Forged brass or cast bronze.
   2. Drain Plug: Brass hex plug.
   3. Screen: 100-mesh monel.
   4. End Connections: Socket or flare.
   5. Working Pressure Rating: 500 psig.
   6. Maximum Operating Temperature: 275 deg F.

L. Moisture/Liquid Indicators:
   1. Body: Forged brass.
   2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
   3. Indicator: Color coded to show moisture content in parts per million (ppm).
   4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
   5. End Connections: Socket or flare.
   6. Working Pressure Rating: 500 psig.
   7. Maximum Operating Temperature: 240 deg F.

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M. Replaceable-Core Filter Dryers: Comply with AHRI 730.
   1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
   2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
   3. Desiccant Media: Activated alumina or charcoal.
   4. Designed for reverse flow (for heat-pump applications).
   5. End Connections: Socket.
   6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
   7. Maximum Pressure Loss: 2 psig.
   8. Rated Flow: .
   9. Working Pressure Rating: 500 psig.
   10. Maximum Operating Temperature: 240 deg F.

N. Permanent Filter Dryers: Comply with AHRI 730.
   1. Body and Cover: Painted-steel shell.
   2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
   3. Desiccant Media: Activated alumina or charcoal.
   4. Designed for reverse flow (for heat-pump applications).
   5. End Connections: Socket.
   6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
   7. Maximum Pressure Loss: 2 psig.
   8. Rated Flow: .
   9. Working Pressure Rating: 500 psig.
   10. Maximum Operating Temperature: 240 deg F.

O. Mufflers:
   1. Body: Welded steel with corrosion-resistant coating.
   2. End Connections: Socket or flare.
   3. Working Pressure Rating: 500 psig.
   4. Maximum Operating Temperature: 275 deg F.

P. Receivers: Comply with AHRI 495.
   1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   2. Comply with UL 207; listed and labeled by an NRTL.
   3. Body: Welded steel with corrosion-resistant coating.
   4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
   5. End Connections: Socket or threaded.
   6. Working Pressure Rating: 500 psig.
   7. Maximum Operating Temperature: 275 deg F.

Q. Liquid Accumulators: Comply with AHRI 495.
   1. Body: Welded steel with corrosion-resistant coating.
   2. End Connections: Socket or threaded.
   3. Working Pressure Rating: 500 psig.
   4. Maximum Operating Temperature: 275 deg F.

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R. FLEXIBLE CONNECTORS
1. Corrugated stainless steel bronze hose with single layer of stainless steel exterior braiding, minimum 6 inches long with copper tube ends; for maximum working pressure 500 psi.

2.4 REFRIGERANTS

A. ASHRAE 34, R-134a: Tetrafluoroethane.

B. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT;

A. Hot-Gas, Liquid, and Suction Lines for Conventional Air-Conditioning and heat pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints as per the manufacture's recommendations. Use ARC tubing only if specially allowed by the equipment manufacture.

B. Safety-Relief-Valve Discharge Piping: Copper, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

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H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

K. Install receivers sized to accommodate pump-down charge.

L. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15 and in accordance the unit manufactures guidelines. Maintain refrigerant velocities within manufactures recommendations in order to keep oil entrained.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

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K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

U. Install refrigerant pipping to allow expansion and contraction of piping without deformation or bending or sagging. Provide expansion fittings, bends or elbows to allow expansion in accordance with manufactures temperature operating range.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

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1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

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E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

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SECTION 23 29 13 - VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency drives.

1.02 RELATED SECTIONS

A. Section 23 21 23 - Hydronic Pumps.

B. Section 16195 - Electrical Identification: Engraved nameplates.

1.03 REFERENCES

A. Division 1 - Reference Standards: Requirements for references and standards.

B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

C. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

F. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Division 1 - Submittals: Procedures for submittals.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and over current protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

1.05 SUBMITTALS FOR INFORMATION

A. Division 1 - Submittals: Submittals for information.

B. Test Reports: Indicate field test and inspection procedures and test results.

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C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.06 SUBMITTALS FOR CLOSEOUT

A. Division 1 - Contract Closeout.

B. Operation Data: NEMA ICS 3.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: NEMA ICS 3.1. Include routine preventive maintenance schedule.

D. Furnish two of each air filters.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Division 1 - Material and Equipment: Transport, handle, store, and protect products.

B. Accept controllers on site in original packing. Inspect for damage.

C. 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.

D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.09 MAINTENANCE SERVICE

A. Division 1 - Contract Closeout.

B. Provide service and maintenance of controller for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Equipment and devices can be provided by Danfoss Graham VLT 6000 Series 414-355-8800.

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B. Manufacturer Qualifications: Company specializing in manufacturing variable frequency controllers with minimum five years documented experience, and with service facilities within 50 miles of Project.

2.02 DESCRIPTION

A. Enclosed variable frequency controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7.

B. Select unspecified features and options in accordance with NEMA ICS 3.1.

C. Furnish complete variable frequency VFDs as specified herein for the equipment designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD. VFD's used out doors must be in a NEMA 4x rated enclosure.

D. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

E. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

F. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

G. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

H. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.

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I. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

J. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

K. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

L. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

M. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

N. Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

O. VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

2.03 PROTECTIVE FEATURES

A. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

B. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain English. Codes are not acceptable.

C. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, and 313 V AC for 460 volt units.

D. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

E. VFD package shall include semi-conductor rated input fuses to protect power components.

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F. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the VFD manufacturer must ensure that inverter rated motors are supplied.

G. VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

H. VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

I. VFD shall catch a rotating motor operating forward or reverse up to full speed.

J. VFD shall be rated for 100,000 amp interrupting capacity (AIC).

K. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

L. VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VFDs, and 539 V AC on 460 volt VFDs.

M. All three pole variable frequency controllers (VFD) either integral to equipment or field supplied shall contain voltage fault protection specifically designed to protect all motors and all other 3 phase loads, and associated control circuits from failure or damage due to voltage unbalance, over/under voltage, phase loss, reversal, incorrect sequencing and rapid short cycling." The VFD shall be arranged to monitor critical faults including phase loss or reversal, and when detected, de-energize the load. It shall monitor non-critical faults including high/low voltage, voltage unbalance and when detected, after a time delay de-energize the load."

2.04 INTERFACE FEATURES

A. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

B. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

C. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

D. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

E. The keypads for all sizes of VFDs shall be identical and interchangeable.

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F. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.

G. Display shall be programmable to display in 9 languages including English, Spanish and French.

H. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

I. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

J. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.

K. The VFD shall include a standard RS-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.

L. As a minimum, the following points shall be controlled and/or accessible:

1. VFD Start/Stop
2. Speed reference
3. Fault diagnostics
4. Meter points

   a. Motor power in HP
   b. Motor power in kW
   c. Motor kW-hr
   d. Motor current
   e .Motor voltage
   f. Hours run
   g. Feedback signal #1
   h. Feedback signal #2
   i. DC link voltage
   j. Thermal load on motor
   k. Thermal load on VFD
   l. Heat sink temperature

5. Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the FD.

M. The communication protocol shall be native BACNET, LonWorks communication shall be available for factory or field installation within the VFD.

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N. Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

O. An output signal as a start command to actuate external equipment before allowing the VFD to start.

P. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

Q. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (^{o}F) for a cooling tower application.

R. VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

S. If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to it's normal switching speed.

T. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.

U. The VFD shall store in memory the last 10 faults and related operational data.

V. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

W. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.

X. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

Y. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

Z. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

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2.05 ADJUSTMENTS

A. VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

B. Sixteen preset speeds shall be provided.

C. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

D. Four current limit settings shall be provided.

E. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under voltage, over voltage, current limit and inverter overload.

F. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

G. An automatic “on delay” may be selected from 0 to 120 seconds.

2.07 SERVICE CONDITIONS

A. Ambient temperature, -10 to 40°C (14 to 104°F).

B. 0 to 95% relative humidity, non-condensing.

C. Elevation to 3,300 feet without derating.

D. AC line voltage variation, -10 to +10% of nominal with full output.

E. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings and as instructed by manufacturer.

3.02 INSTALLATION

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A. Section 01400 - Quality Control: Manufacturer's instructions.

B. Install in accordance with NEMA ICS 3.1.

C. Tighten accessible connections and mechanical fasteners after placing controller.

D. Provide fuses in fusible switches; refer to Section 16477 for product requirements.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Provide engraved plastic nameplates; refer to Section 16195 for product requirements and location.

G. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16.2.

3.04 MANUFACTURER'S FIELD SERVICES

A. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.05 ADJUSTING

A. Division 1 - Contract Closeout.

B. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.06 DEMONSTRATION AND INSTRUCTIONS

A. Division 1 - Contract Closeout:

B. Demonstrate operation of controllers in automatic and manual modes. Furnish 2 (1) one hour training sessions on the project site with the owner, by factory authorized personal.

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END OF SECTION

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." Review structural plans for Hazard classifications.

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. All ductwork shall be constructed and erected in accordance with the Mechanical Code of New York State.

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1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment.
13. Seismic restraints, where applicable
14. Vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. 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.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

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B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. **Welding Qualifications:** Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. **Welding Qualifications:** Qualify procedures and personnel according to the following:
1. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. Construct ductwork to NFPA 90A and NFPA 90B standards. All work, materials and equipment shall comply with the latest requirements of NFPA 90A, standards and the local authorities having jurisdiction.

E. All ductwork and fan and apparatus plenums constructed and having supported in accordance with the latest standards of the ASHRAE Guide and the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

F. Bracing, gauges, and supports indicated in SMACNA manuals are the minimum acceptable. Additional bracing or supports shall be installed to eliminate any distortion or vibration when the systems are operating or under tests.

PART 2 - PRODUCTS

2.1 General

A. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

B. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.

C. Dissimilar Metals: Separate connections between dissimilar metals with Dielectric Insulation. Joints between dissimilar metal duct sections to be made with Companion flanges separated by a Neoprene gasket.

D. Fasteners: Rivets, bolts, screens, and other hardware used in the sheet metal construction to be constructed of materials identical or similar to the duct material to prevent galvanic corrosion.

E. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic as manufactured by 3M Company EC-800.

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F. Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Provide products from one of the following manufactures
   1. McGill Airflow LLC
   2. Zen Industries
   3. Lindab
   4. Spiral Manufacturing Co. Inc

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

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1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M. (ALL AC SYSTEMS EXCEPT KITCHEN EXHAUST)

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M. (NATATORIUMS)

1. Galvanized Coating Designation: G90.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: (KITCHEN EXHAUST SYSTEMS)
1. Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: (KITCHEN EXHAUST SYSTEMS)
1. Comply with ASTM A 480/A 480M, Type 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

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F. Aluminum Sheets: (OAI DUCTWORK)
   1. Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:

   1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
   2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
   4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
   5. Shop-Applied Coating Color: Black OR White.
   6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

   a. Maximum Thermal Conductivity:

      1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

   2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Solvent Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

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1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

C. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B. **For application in damp or humid environments including natatoriums and Saunas .**

D. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel to match ductwork; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

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2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

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1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service or an agency acceptable to authorities having jurisdiction.

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1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

C. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths and with fewest possible joints

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections. *Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 0 degrees divergence upstream of equipment and 45 degrees convergence downstream.*

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

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G. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness and with sufficient space around equipment to allow normal operating and maintenance activities. *Provide easements where ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.*

H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for all installations as well as fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. 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.

N. Where hanger rods must pierce ducts, provide closure plates around rods and fasten to duct using screws, rivets or welding. Seal with sealing compound.

O. 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 are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

P. Where ductwork penetrates roofs or outside walls, seal the space around ductwork air tight with fire rated expanding spray foam sealer similar to 3-M Fire Block Foam. This also applies to duct roof penetrations into roof curbs.

Q. All ductwork shall be inspected and pressure tested prior to enclosing in general construction or concealment above hung ceilings

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

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B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Prime ductwork and paint with one coat enamel base paint. Color as per architectural plans. All ductwork surface finish shall be treated prior to priming by "pickling" in accordance with industry standards and paint manufactures requirements.

G. All ductwork in any building that is exposed to view, (except mechanical equipment rooms), shall double wall round ductwork or oval as indicated on plan. Where ductwork is to be painted, it shall be primed. Refer to the architectural plans for where ductwork shall be painted. Submit paint color chart for review and approval. Primer shall be specifically formulated for galvanized steel.

H. Duct sealants used on exposed ductwork of any type shall be clear.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCT

A. No 16 USSG black steel.

B. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

C. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Cleanout doors on horizontal duct shall be mounted on side of duct. Bottom edge shall be not less than 2 inch above bottom of duct. Cleanout doors at vertical ducts shall be mounted at base. Door and frame shall be same gauge as duct. Hinges shall be Ventlock No. 260, extra heavy zinc plated. Latches shall be Ventlock No. 140, cast zinc. Gaskets shall be between door and frame. Gaskets shall be 1/8 inch double thickness rated for 2000 degree F. Cleanout door size shall be 24 inch one side, and other side shall be 2 inch less than duct height. Where openings are to large for side installation the opening shall be installed on the top or bottom, in accordance with approved methods. Where duct dimensions preclude top or bottom installation install clean outs ON THE duct face that will allow the largest opening with edges as described above.

D. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

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E. All seams, joints and penetrations shall be liquid tight continuous external arc welded, except where the duct stub collar of the hood is connected to the exhaust duct. Connection to the hood shall be continuous liquid tight external arc welded or in accordance with the NFPA 96.

F. Angle reinforcing shall be minimum 1 1/2 inch X 1 1/2 inch X 3/16 inch at maximum 4 ft. on centers and in accordance with SMACNA Rectangular Industrial Duct Contraction Standards shall be mounted.

G. Duct to hood joints shall be made with continuous liquid tight external welds. Alternatively, the joint shall be made by flange. Flanges shall be 1" wide full perimeter fully welded. Flange connections shall have gaskets rated for 1500°f, secured by .25" dia (minimum) bolts on 4" centers for the full perimeter secured with lock washers.

H. Duct to fan connections shall be made in a similar fashion as duct to hood connections. Where vibration isolation is required, flexible duct connections to fans shall be made coated fabric flexible connectors listed & labeled for the application.

I. Horizontal grease ducts less than 75' long shall be installed to slope toward hoods at a rate of 3" per foot. Horizontal grease ducts of 75' or longer shall slope toward hoods at a rate of 1" per foot.

J. kitchen exhaust duct insulation: 1" fire resistant duct wrap consisting of light weight, non-asbestos high temperature non-organic ceramic fiber blanket encapsulated in foil/scrim having a service temperature rating of 2300º f. Wrap shall be applied in two layers to provide a two-hour rated enclosure assembly. Bonding material shall be 304 stainless steel, ¾" wide and .015" thick. Install layers as per the manufactures details and specifications to achieve the required fire rating.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR LAUNDRY EXHAUST DUCTWORK

A. All clothes dryers shall be exhausted in accordance with manufacturer instructions.

B. Fire, smoke, combination dampers or other similar devices that will obstruct flow are prohibited in the exhaust system.

C. Provide cleanouts at the base of each vertical section and riser.

D. Ducts shall not be connected or installed with sheet metal screws or other fasteners that protrude more than 1/8" into the inside of the duct.

E. All exhaust fans shall be listed and labeled to UL 705 and installed in accordance with the manufacturer’s instructions. Fan motors shall be outside of the airstream and operate continuously. (provide standby power)

F. All duct elbows must be radius elbows, square elbows and/or turning vanes are not permitted.

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G. Each riser shall be an independent system of exhaust fan, pressure sensor, motor controller and associated wiring, supports and specialties.

H. Refer to floor plans for riser offsets as noted; provide cleanouts at all vertical sections.

I. Provide sub-duct for each dryer connection. Re: mechanical equipment notes for make and model. Install in accordance with manufacturer instructions.

J. Exhaust riser shall be installed in a shaft constructed and fire-resistance rated as required by code; re: architectural plans for shaft construction.

3.5 DUCT SEALING

A. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

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5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Where hanger rods must pierce ducts, provide closure plates around rods and fasten to duct using screws, rivets or welding. Seal with sealing compound

3.7 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service or an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

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2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. 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.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.8 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

C. Smoke purge supply and exhaust systems and stair pressure systems. Flexible connection shall be permitted at diffusers, a maximum of 3' long, and flexible connections are permitted at air handling equipment for vibration isolation only.

D. INSULATED FLEXIBLE DUCTS
1. UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; polyethylene vapor barrier film.
2. Pressure Rating: 8 inches WG positive or negative.
3. Maximum Velocity: 5000 fpm
4. Temperature Range: -20 degrees F to 250 degrees F.

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

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a. All Ducts with a Pressure Class eaqual to or Higher Than 2-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each system of the designated pressure class.

b. All smoke purge system Ducts, including supply exhaust and return air. All stair pressurization ductwork. Test representative duct sections totaling no less than 50 percent of total installed duct area of each system.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

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2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.12 SMOKE AND HEAT DETECTOR INSTALLATION

A. Duct mounted smoke and heat detectors will be supplied under the Electrical Division. This Contractor to coordinate duct sizes and provide labor to install sensing probes into ductwork.

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3.13 DUCTWORK PROTECTION

A. Duct work under construction or alteration shall not be left open ended during dust producing construction. All new and existing ductwork systems in the area of alteration or under construction shall be protected during construction. Open ends ducts shall be sealed with sheet metal or as approved.

B. For unenclosed buildings ductwork shall be kept dry and water tight. Seal open ends water tight during construction to prevent water infiltration. Keep all acoustical lining dry during construction. Lining that has become we shall be replaced. all incomplete ductwork being used to condition spaces in phase I or phase II that will be completed under a later phase must be protect from being internally contaminated by construction dust. All returns opening must have filters placed over then to prevent dust from being returned to the unit.

3.14 DUCT SCHEDULE

A. Fabricate ducts using the following material;

1. Underground Ducts: Concrete-encased PVC-coated galvanized steel, or Concrete-encased stainless steel, or fiberglass.
2. Natatorium ductwork – PVC coated galvanized steel.
3. Kitchen exhaust – welded stainless steel or black steel
4. Smoke purge ductwork - welded stainless steel or black steel.
5. Shower / toilet room exhaust – aluminum
6. Dryer exhaust – aluminum or galvanized steel
7. Outside air intake plenum and ductwork - Aluminum
8. Above ground in MER, conditioned space or unconditioned spaces – galvanized steel

B. Duct Pressure class;

1. All duct systems shall be constructed to have a pressure classification based on the maximum static pressure (positive or negative) operating pressure (OP), developed by the air handling apparatus connected to the ductwork system. Unless otherwise noted below, refer to the equipment schedules and equipment notes for the design operating pressure of each system. Systems with operating pressures between pressure classes shall be constructed to the next higher pressure class.

Pressure Classification Table						
System operating pressure (OP) in wc	OP≤1"	1"≥OP<2"	2"≥OP<3"	3"≥OP<4"	4"≥OP<6"	6"≥OP<10"
SMACNA Construction classification	1"	2"	3"	4"	6"	10"

2. All ductwork shall be constructed in accordance with the leakage and seal classification. Note that the leakage and seal classification required by current code is more stringent than SMACNA requirements.

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Leakage and Seal Classification Table			
System operating pressure in wc	<2" low	2"≥med<3"	High≥3"
Seal Class	C	B	A
Sealing	Transverse joints	Transverse joints and seams	Transverse joints and seams and all wall penetrations
Leakage class CL factor	24	12	4
In addition to the above, any variable air volume system duct of 1″ and ½″ wg con-struction class that is upstream of the VAV boxes shall meet Seal Class C.			

C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:

   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

D. Liner for sound attenuation:

1. Supply, Return and exhaust air ducts: ½” inches thick.
2. Supply and return fan Plenums: 1” inches thick.
3. Transfer Ducts: 1 inch thick.
4. Ductwork down stream from VAV boxes for 10’
5. At the inlet and discharge of all fans for a distance of 15’
6. Apply galvanized steel noising to the leading edge of all sound linings

E. Double-Wall Duct Interstitial Insulation:

1. Supply, Return, Exhaust Air Ducts: 1” inches thick. (when ducts are exposed in the conditions space)
2. Supply, Return, Exhaust Air Ducts: 1 1/2” inches thick. (when ducts are concealed in plenums or are located in unconditioned spaces)

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F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm:

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

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3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter:
c. Round Elbows, 14 Inches and Larger in Diameter:

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling radiation dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Duct accessory hardware.
17. Duct Roof Supports

B. Related Requirements:

1. Section 233113 Metal Ducts
2. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
3. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

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B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise

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indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. Buckley

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: up to 6”wc.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel or 0.063-inch-thick extruded aluminum, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, or off-center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

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G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Galvanized, steel Stainless steel, or Aluminum.
2. Diameter: 0.20 inch min.

J. Tie Bars and Brackets: Aluminum or Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

   a. Sleeve Thickness: 20 gage minimum.
   b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel or Aluminum.
8. Screen Type: Bird. ½ x ½ max opening
9. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. Buckley

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: upto 6-inch wg.

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E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel or 0.063-inch-thick extruded aluminum, with welded corners or mechanically attached and mounting flange.

F. Blades:

1. Multiple, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted or Off-center pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Galvanized steel, aluminum, or Stainless steel.

I. Tie Bars and Brackets:

1. Material: Aluminum or Galvanized steel.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic, Stainless steel, Bronze.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Tek Group.
b. McGill AirFlow LLC.
c. Nailor Industries Inc.
d. Pottorff.
e. Ruskin Company.
f. Vent Products Co., Inc.
g. Buckley

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
4. Frames:

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a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized or Stainless-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel, Stainless or steel Nonferrous metal.
7. Bearings:

a. Oil-impregnated bronze, molded synthetic, Oil-impregnated stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGill AirFlow LLC.
b. Nailor Industries Inc.
c. Pottorff.
d. Ruskin Company.
e. Vent Products Co., Inc.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

6. Blade Axles: Galvanized steel or Stainless steel.
7. Bearings:

a. Oil-impregnated bronze, Molded synthetic, or Stainless-steel sleeve.

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b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. McGill AirFlow LLC.
   b. Nailor Industries Inc.
   c. Pottorff.
   d. Ruskin Company.
   e. Vent Products Co., Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

   a. U or Angle shaped.
   b. 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
   c. Mitered and welded corners.
   d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized or Stainless, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Galvanized steel or Stainless steel.
8. Bearings:

   a. Oil-impregnated bronze, molded synthetic, Oil-impregnated stainless-steel sleeve, Stainless-steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel or aluminum.
11. Tie Bars and Brackets: Galvanized steel or Aluminum.
12. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

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D. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. McGill AirFlow LLC.
   b. Nailor Industries Inc.
   c. Pottorff.
   d. Ruskin Company.
   e. Vent Products Co., Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames: U or Angle-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
   d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

7. Blade Axles: Galvanized steel, Stainless steel.
8. Bearings:

   a. Oil-impregnated bronze, Molded synthetic, Oil-impregnated stainless-steel sleeve, Stainless-steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel, aluminum.
11. Tie Bars and Brackets: Galvanized steel, Aluminum.
12. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:

1. Size: 0.5-inch diameter min.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware:

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1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.6 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. U or Angle shaped.
2. 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel blade for non modulating application
3. Opposed-blade design for all modulating applications
4. Galvanized-steel, Stainless steel, Aluminum.
5. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
6. Blade Edging: Closed-cell neoprene.
7. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch-diameter; galvanized steel, or stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze, Molded synthetic, Oil-impregnated, stainless-steel sleeve, or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

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2.7 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.
6. Ward Industries; a brand of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades inside airstream for application in duct over 24" in height. Curtain type with blades outside airstream for ducts 24" or less in height. Multiple-blade type; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch upto 4 SF 0.39 over 4 SF inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.8 CEILING RADIATION DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aire Technologies.
2. Nailor Industries Inc.
3. Pottorff.
4. Prefco.

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5. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 1hr for applications in assemblies up to 1 ½ hr rating. 2hr for application in assemblies of up to 3hr

2.9 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection. Except for NYC smoke detector shall be provided by the fire alarm contractor.

D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- thick, galvanized sheet steel.

F. Leakage: Class I.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: Modulating or two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

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1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switches for signaling, fan control and position indication.
2. Test and reset switches, damper or remote mounted.
3. Manual damper testing by physically depressing the low temperature thermal disc from the inside of the damper sleeve and resetting the sensor from the exterior side of the damper sleeve.
4. Dual position blade indicator switch package shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.
5. Dual Position Indicator Switch Package: Shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.
6. Duct Smoke Detector: Factory mounted in the damper sleeve with interconnecting wiring from the damper actuator to the smoke detector enabling a single power connection point for easy field wiring.

2.10 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

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D. Fire Rating: 1-1/2 for assemblies upto 2 hour and 3 hr rating for assemblies over 1 1/2hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Primary heat responsive device set at 285 deg F, resettable.

G. Secondary heat closure device, set at 350 deg F, resettable.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Blades: Roll-formed, horizontal, interlocking, 0.063-inch- thick, galvanized sheet steel.

J. Leakage: Class I.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.039-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Modulating or two-position action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. **Electrical Connection: 115 V, single phase, 60 Hz.**

P. Accessories:

A. DRS-30 Two-Temperature Fire Closure Device:

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1. UL classified two-temperature device permits the damper to be re-opened after initial temperature closure allowing the damper to remain operable for smoke management purposes until the high temperature limit is reached.
2. Manual damper testing is permitted by physically depressing the low temperature thermal disc from the inside of the damper sleeve and resetting the sensor from the exterior side of the damper sleeve.
3. Dual position blade indicator switch package shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.

B. PI-50 Dual Position Indicator Switch Package: Shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.

C. Duct Smoke Detector: Factory mounted in the damper sleeve with interconnecting wiring from the damper actuator to the smoke detector enabling a single power connection point for easy field wiring.

2.11 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Hardcast, Inc.
4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.12 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.
5. Industrial Acoustics

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B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90 , galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.05 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch-diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative or Film-lined type with fill material.

   a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression and Moisture-proof nonfibrous material.
   b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Fiberglas cloth.

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J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Joints: Lock formed and sealed or continuously welded or flanged connections.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Accessories:

1. Integral 1-1/2 3-hour fire damper with access door. Access door to be high transmission loss to match silencer.
2. Factory-installed end caps to prevent contamination during shipping.
3. Removable splitters.
4. Airflow measuring devices.

L. Source Quality Control: Test according to ASTM E 477.

1. Testingto be witnessed by Engineer.
2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

M. Capacities and Characteristics:

1. Configuration: Straight or 90-degree elbow as indicated on plan
2. Shape: Rectangular or Round as indicated on plan
3. Attenuation Mechanism: Acoustical glass fiber with protective film liner.
4. Maximum Pressure Drop: 0.25-inch wg.
5. Casing:

   a. Attenuation: Standard.
   b. Outer Material: Galvanized steel.
   c. Inner Material: Galvanized steel.

6. Velocity Range: 500 fpm max.
7. End Connection: 1-inch slip joint or Flange.
8. Length: as per plan
9. Face Dimension:

   a. Width: as per plan
   b. Height: as per plan

10. Face Velocity: as per plan
11. Dynamic Insertion Loss: as per plan
12. Generated Noise: as per plan
13. Accessories:

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a. Access door.
b. Birdscreen.

2.13 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.
3. Ductmate Industries, Inc.
4. Duro Dyne Inc.
5. METALAIRE, Inc.
6. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.14 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Copper or Aluminum.

D. Cable: Steel.

E. Wall-Box Mounting: Recessed.

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F. Wall-Box Cover-Plate Material: Stainless steel.

2.15 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles for plenum applications.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges or Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.

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8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.16 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Ductmate Industries, Inc.
3. Flame Gard, Inc.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.17 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. Elgen Manufacturing.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches or 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

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F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.18 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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2.19 DUCT ROOF SUPPORTS

A. Ductwork shall be supported a minimum of 12” above the roof with “H” stand manufactured by RTS. Roof support systems. All parts shall be manufactured from hot dipped galvanized steel 1 5/8” channels. All fasteners shall be hot dipped galvanized steel or nickel plated. All channels that are filed cut shall be finished with cold galvanizing at all unfinished edges. All stands shall have two lateral horizontal cross members

B. “H” stands shall use double base. Gusseted 2”x2” square receiver base plate mounted on 14.5”x17.5” x2” think neoprene pad model RTSF21G.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.
   3. Install stainless steel volume dampers in stainless steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inchsteel sleeve, continuously welded at all joints and 1/2-inch-diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible

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connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

I. Connect ducts to duct silencers rigidly.

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing and the bottom of all riser in Laundry exhaust ducts.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

K. Install access doors with swing against duct static pressure.

L. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

M. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install flexible connectors to connect ducts to equipment.

O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

Q. Connect diffusers or light troffer boots to ducts with maximum 30-inch lengths of flexible duct clamped or strapped in place.

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R. Connect flexible ducts to metal ducts with draw bands.

S. Install duct test holes where required for testing and balancing purposes.

T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

U. Install remote volume damper operators for all volume dampers that are concealed an not accessible after finished construction is complete.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

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SECTION 23 34 23 HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Centrifugal roof ventilators.
2. Ceiling-mounted ventilators.
3. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

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

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

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1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: 2 set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ACME Company.

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2. Central Blower Company.
3. Greenheck Fan Corporation.
4. Loren Cook Company.
5. PennBarry.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector (for kitchen hood applications).
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside or outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Barometric Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops. *Refer to plan for project configuration.*
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. *Refer to plan for project configuration.*

F. Special Considerations for Kitchen Hood Exhaust Applications:

a. No back-draft discharge damper for kitchen hood exhaust applications
b. Minimum curb Height: 18”. Coordinate the exact curb height in the field so that the top of the fan is a minimum of 40” above the roof.
c. Roof curb shall be vented without insulation.
d. Provide grease drain line and cup
e. Provide hinged
f. NEMA 3R external unit mounted disconnect switch.
g. Bird screen with heat baffle
h. Fan shall be hinge mounted to curb for access to the wheel and ductwork
i. UL 762 rated for continuous operation up to 300 deg F.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

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1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Minimum Height: 18 inches. For Kitchen exhaust applications coordinate the curb height in the field so that the top of the fan is a minimum of 40" above the roof.
3. Sound Curb: Curb with sound-absorbing insulation.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares. (Not required unless scheduled)
7. Mounting Pedestal: Galvanized steel with removable access panel.
8. Vented Curb: Unlined with louvered vents in vertical sides. (for kitchen hood exhaust applications).

H. Controls:
1. TX-2; Toilet and Shower rooms: Provide a 24/7 digital time clock to operate the fan based programmed time setting.
2. KX-1; the kitchen exhaust fan shall be operated through a push button starter mounted on the wall in the kitchen. The starter shall have a green running light and a red light when in the stop mode. The starter shall also have a auto mode. Provide a temperature sensor under the kitchen exhaust hood arranged to automatically start the fan upon reaching set point temperature.
3. GX-1 and GX-2. Emergency Apparatus Bay Exhaust. shall be arranged to be interlocked with to operate through the CO detection system. Refer to specification section 230923 Gas Instruments for additional information. When the fans are energized to run the relief air dampers shall open.

2.2 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carnes Company.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Steel, lined with acoustical insulation. Housing shall be field adaptable for inline installation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Aluminum or Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

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1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit. Externally mounted disconnects shall be NEMA 3R
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Wall Grille: Ring type for flush mounting.
5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.

G. Controls;
1. TX-2; WC 124. Provide a wall mounted switch with time delay so that the fan continuous to run for a period of time after turning the switch off.

2.3 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carnes Company.
2. Greenheck Fan Corporation.
3. ACME Fan Incorporated.
4. Loren Cook Company.
5. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent. (where scheduled or indicated on plan)
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
6. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside or outside fan housing, factory wired through an internal aluminum conduit.

G. Controls:

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1. SF-1. Drying room. Provide a hand off auto Switch in the room. Off mode, the fan shall be deenergized. In the hand mode the fan shall be manually started. The OAI and relief air dampers shall open. A wall thermostat shall operate the energize the electric duct heater maintain room temperature set point of 70 deg F adjustable.
2. GS-1 Apparatus Bay SA; GS-1 shall be arranged to be interlocked with to operate through the CO detection system. Refer to specification section 230923 Gas Instruments for additional information. When the fan is energized to run the OAI damper shall open. The electric duct heater EDH-1 shall be arranged to maintain 55 deg F SA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators or restrained spring isolators for projects with seismic requirements having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounted units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."

B. Kitchen exhaust hood fans shall not have flexible connections or back draft dampers.

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C. Install ducts adjacent to power ventilators to allow service and maintenance.

D. Prove flexible duct connections for all fans except Kitchen exhaust fans.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Comply with requirements in "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

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E. Mechanical schedules and equipment notes indicate estimated static pressures and resultant RPM. If, during balancing, it is determined that the sheaves supplied with and fan or air handling unit have reached the maximum adjustment and design static pressure and or CFM can not be obtained then it shall be the mechanical contractors responsibility to remove and change the drive as required to reach design conditions. And it shall be the balancers responsibility to rebalance the system as appropriate to achieve design conditions after the drives have been changed.

END OF SECTION

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SECTION 235123 – LISTED SPECIAL GAS VENTS

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. Listed double-wall vents.

B. Related Requirements:

1. Section 235216.11 "Condensing Boilers”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

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1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Heatfab Saf-T Vent.
2. Metal-Fab, Inc.
3. Security Chimneys International.
4. Selkirk Corporation.

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1” interstitial insulation

D. Inner Shell: ASTM A959, Type 29-4C stainless steel.

E. Outer Jacket: Aluminized steel or Stainless steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 APPLICATION

A. Listed Special Gas Vent: All Condensing gas appliances.

3.3 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

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SECTION 235216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for boiler, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control reports.

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C. Field quality-control reports.

D. Sample Warranty: For special warranty.

E. Product Certificates:

1. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
2. CSA B51 pressure vessel Canadian Registration Number (CRN).

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:
   a. Heat Exchanger Damaged by Thermal Stress and Corrosion: Commercial Nonprorated for 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.

E. UL Compliance: Test boilers for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

F. CSA Compliance: Test boilers for compliance with CSA B51.

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G. Mounting Base: For securing boiler to concrete base.

1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.

2.2 WATER JACKETED FORCED-DRAFT, FIRE-TUBE CONDENSING BOILERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AERCO; A WATTS Brand.
2. Bosch Thermotechnology Corp.
3. Camus.
4. Cleaver-Brooks.
5. Fulton.
6. Lochinvar.

B. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water-heating service only.

C. Heat Exchanger: Stainless-steel primary and secondary combustion chamber.

D. Nonmetallic heat exchanger base.

E. Burner: Natural gas, (or propane), forced draft; swing-open front and burner observation port. For propane applications, provide gas conversion kit.

F. Blower: Centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.

1. Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

G. Gas Train: Combination gas valve with manual shutoff and pressure regulator. Include 100 percent safety shutoff with electronic flame supervision. For propane applications, provide gas conversion kit.

H. 10:1 turn down ratio

I. Low water cut off

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J. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

K. Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Finish: Baked-enamel or Powder-coated protective finish.
4. Insulation: Minimum 4-inch-thick, mineral-fiber insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.

L. Capacities and Characteristics:
1. Refer to plans and schedules for capacities
2. DOE AFUE; 95.0%

2.3 TRIM

A. Include devices sized to comply with ASME B31.9.

B. Aquastat Controllers: Operating, firing rate, and high limit.

C. Safety (pressure) Relief Valve: ASME rated.

D. Pressure and Temperature Gage: Minimum 3-1/2-inch-diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Automatic.

F. Drain Valve: Minimum NPS 3/4 hose-end drain valve.

G. Circulation Pump: Nonoverloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

H. Condensate neutralization and drain kit with marble chips.

I. BACNet MSTP communications card.

J. High and low gas pressure switches with manual reset.

K. Low water cut off with manual reset and test.

L. 30 PSI pressure relief

2.4 CONTROLS

A. Boiler operating controls shall be direct digital and fully self-contained. The operating control panel shall be mounted on the boiler front panel and shall be fully installed and programmed

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factory packed controller by the boiler manufacture. The controller shall have an LCD screen for user or operator interface.

B. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.
3. Operating Pressure Control: Factory wired and mounted to cycle burner.

4. Sequence of Operation:
   a. Boiler operation shall be enabled by the radiant floor controller panel, RFCP. Contacts in the panel shall close on a call for heat based on outside air temperature. Provide an outside air temperature sensor arranged to be connected to the RFCP.
   b. Once enabled, the boiler shall be arranged to operate through the built-in factory digital display controller located on the boiler.
   c. Hot water temperature setpoint shall be maintained in accordance to a reset schedule. At 55 deg F the water temp shall be 90 deg F. At 0 deg F the HW temp shall be 150 deg F.
   d. The RFCP shall also enable the primary circulator pump to run when the boiler is enabled.

   e. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: (1) Electronic probe shall prevent burner operation on low water. Cutoff switch shall be (1) manual AND (1) automatic-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color coded to match wiring diagram.

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3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to nonfused disconnect switch.
5. Provide branch power circuit to each motor and to controls with a disconnect switch. Provide each motor with overcurrent protection.

2.6 VENTING KITS

A. Provide full boiler venting and OAI ducting. Refer to Section 235123 "Listed Special Gas Vents." For full requirements. The following paragraphs are the minimum requiremetns.

B. ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
   1. Provide all specialty fittings, including offsets, elbows, roof thimble, wall thimble screens and caps from boiler flue to termination point outdoors. Refer to plans for duct arrangement. Boiler vent piping shall be double wall with 2” of insulation and aluminum jacket. Vertical vent piping located inside existing masonry chimneys shall be single wall.

C. Combustion-Air Intake: Complete system, stainless steel, or galvanized steel spiral round ductwork, vent terminal with screen, inlet air coupling, and sealant.
   1. Provide all specialty fittings, including offsets, elbows, screens for CA intake from boiler to OAI louver or termination point outdoors. Refer to plans for duct arrangement.

2.7 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to 2010 ASME Boiler and Pressure Vessel Code.

C. Allow Owner access to source quality-control testing of boilers. Notify engineer 14 days in advance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

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B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting:

1. Install boilers on cast-in-place concrete housekeeping pads Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." and Section 033053 "Miscellaneous Cast-in-Place Concrete." Concrete housekeeping pads shall be 5 ½" high and extend 6" longer on all sides then the mountings, and shall have 45° chamfered edges.
   a. Pumps located above the lowest level (or when the lowest level is above grade), of the building shall be mounted on spring isolation inertia bases.
   b. Grout between boiler base and house keep pad.
2. Wall mounted units shall be securely fastened to building structural members in accordance with the manufactures recommendations.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Install all piping in accordance with manufactures recommendations.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from acid neutralizing device / equipment drain connection to discharge indirectly to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required by manufacturer. Drain piping shall be PVC.

D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section 232116 "Hydronic Piping Specialties."

E. Safety relief valves shall be hard piped, full size of relief valve outlet. Pipe down to within 18" of floor or to nearest floor drain. Discharge at floor drain shall be indirect connection.

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F. Connect gas piping to boiler gas-train inlet with union and shut off valve. Piping shall be at least full size of gas-train connection. Provide a reducer if required. Provide plug valve for shut off and 6" drip leg.

G. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

H. Install piping from safety valves to drip-pan elbow and to nearest floor drain.

I. Boiler Venting:

1. Install flue venting kit and combustion-air intake.
2. Connect full size to boiler connections. Comply with requirements in Section 235123 "Gas Vents."

J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

D. Boiler will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

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G. Performance Tests:

1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
3. Perform field performance tests to determine capacity and efficiency of boilers.

    a. Test for full capacity.
    b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.

4. Repeat tests until results comply with requirements indicated.
5. Provide analysis equipment required to determine performance.
6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are inadequate.
7. Notify engineer 48 hours minimum in advance of test dates.
8. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235216

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SECTION 235533.16 - GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.

1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Items penetrating roof and the following:

a. Vent and gas piping rough-ins and connections.

B. Field quality-control reports.

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C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

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. Fan Belts and filters: One for each belt-driven fan size.

1.7 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Modine

B. Manufacturers: Subject to compliance with project requirements and review and approval by the Engineer products by one of the following may be used:

1. Lennex.
2. REZNOR, a brand of Nortek Global HVAC.
3. Sterling HVAC Products; a Mestek company.

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.

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B. Capacities and Characteristics: refer to plans and schedules

2.3 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel or Powder coating over corrosion-resistant-treated surface.
2. Discharge Louvers: Independently adjustable, horizontal and vertical blades.
3. Discharge Nozzle: Discharge at 10 to 65 degrees from horizontal.

E. Accessories:

1. Four-point suspension kit.
2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
3. Finger proof fan guard
4. horizontal adjustable fan discharge blades.
5. Electronic room thermostat
6. Separated combustion

F. Heat Exchanger: Stainless steel.

G. Burner Material: Stainless steel.

H. Propeller Unit Fan:

1. Formed-steel or Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Centrifugal Unit Fan: (Not Used)

1. Steel, centrifugal fan dynamically balanced and resiliently mounted.
2. Belt-Driven Drive Assembly:

a. Resiliently mounted to housing, with the following features:

1) Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2) Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

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3) Pulleys: Cast-iron, adjustable-pitch motor pulley.

J. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Enclosure Materials: Rolled steel.
3. Motor Bearings: 200000.

4. Efficiency: Premium efficient.
5. NEMA Design: 1.
6. Service Factor: 1.5.

K. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: 2-stage
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Flame rollout switch or Differential pressure switch to verify open vent.
5. Control transformer.
6. High Limit: Thermal switch or fuse to stop burner.
7. Thermostat: Devices and wiring are specified in Section 230923.27 "Temperature Instruments."
8. Wall Mounted Thermostat:

a. Two stage.
b. Fan on-off-automatic switch.
c. 24-V ac.
d. 50 to 90 deg F operating range.

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

M. Provide manufactures wall mounted thermostat with set point adjustment and summer winter change over.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

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3.2 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section 221123 " Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with Section 235123 "Special Listed Gas Vents."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

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3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION 235533.16

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SECTION 238129 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed, ceiling-mounted units for ducting.
2. Indoor, exposed, floor-mounted units.
3. Indoor, exposed, wall-mounted units.
4. Indoor, recessed, ceiling-mounted units.
5. Outdoor, air-source heat recovery units.
6. Heat recovery control units.
7. System controls.
8. System refrigerant and oil.
9. System condensate drain piping.
10. System refrigerant piping.
11. Metal hangers and supports.
12. Metal framing systems.
13. Fastener systems.
14. Pipe stands.
15. Miscellaneous support materials.
16. Piping and tubing insulation.
17. System control cable and raceways.

1.3 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and

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cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

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 for indoor and outdoor units and for HRCUs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

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1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

1. Include a Sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, ductwork, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Service access panels.
f. Fire alarm devices

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

a. Retain copies of Installer certificates on-site and make available on request.

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2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Product Test Reports: Where tests are required, for each product, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

a. One set(s) for each unit with replaceable filters.
b. One set(s) for each unit type and unique size of washable filters.

2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.
4. Insert maintenance material requirements.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five years within time of bid.

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3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
    e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
3. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

4. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
5. Service and maintenance staff assigned to support Project during warranty period.
6. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.

D. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

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1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
d. .

2. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Daikin AC (Americas), Inc

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:

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1. Carrier Corporation /Toshiba .
2. Fujitec America, Inc.
3. LG Electronics.
4. Samsung HVAC.

C. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Refrigerant isolation valves.
5. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

B. The condenser shall be a direct expansion (DX), air-cooled heat recovery, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant. The condensing unit may connect an indoor evaporator capacity up to 200% of the condensing unit capacity. All zones are each capable of operating separately with individual temperature control. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance. Two-pipe, heat recovery systems utilizing a lower temperature mixed liquid/gas refrigerant to perform heat recovery are not acceptable due to reduced heating capabilities.

1. three-pipe system design.
2. System(s) operation, heat recovery as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

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.

D. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

E. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 135: For control network protocol with remote communication.
3. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

F. UL Compliance: Comply with UL 1995.

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2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer or specialist, as defined in Section 014000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.

1. Provide system refrigerant calculations.

   a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
   b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:

   a. Arrangement: Arrange piping to interconnect indoor units, HRCUs, and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
   b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
   c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

4. System Controls:

   a. Network arrangement.
   b. Network interface with other building systems.
   c. Product selection.
   d. Sizing.

B. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

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C. System Installation Requirements:

1. Install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than 60 percent.
2. Not more than 130 percent.
3. Range acceptable to manufacturer.

F. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

H. Operating range:
1. The operating range in cooling or cooling dominant simultaneous cooling/heating will be -4°F DB ~ 122°F DB.
2. Each system as standard shall be capable of onsite reprogramming to allow low ambient cooling operation down to -4°F DB
3. The operating range in heating or heating dominant simultaneous cooling/heating will be -13°F WB – 60°F WB.
4. If an alternate equipment manufacturer is selected, the mechanical contractor shall provide, at their own risk and cost, all additional material and labor to meet low ambient operating condition and performance.
5. Cooling mode indoor room temperature range will be 57°F-77°F WB.
6. Heating mode indoor room temperature range will be 59°F-80°F DB

I. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated. Each system shall use indoor and condensing units with quiet operation at 27 dB(A)

J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, HORIZONTAL OR VERTICAL UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

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1. Material: Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:

1. Fan(s):

   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

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1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 13.

    a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Accessories:
1. Remote Room Temperature Sensor /thermostat: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

H. Unit Controls:

1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

    a. Unit inlet air temperature.
    b. Coil entering refrigerant temperature.
    c. Coil leaving refrigerant temperature.

4. Field-Customizable I/O Capability:

    a. Analog Inputs: Four for use in customizable control strategies.
    b. Digital Inputs: Four for use in customizable control strategies.
    c. Digital Outputs: Four for use in customizable control strategies.

5. Features and Functions:

    a. Self-diagnostics.
    b. Time delay.
    c. Auto-restart.
    d. External static pressure control.
    e. Auto operation mode.
    f. Manual operation mode.
    g. Filter service notification.
    h. Power consumption display.
    i. Drain assembly high water level safety shutdown and notification.
    j. Run test switch.

6. Communication: Network communication with other indoor and outdoor units.
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.

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2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways.

2.5 INDOOR, EXPOSED, FLOOR-MOUNTED CONSOLE UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

   a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:

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1. Fan(s):

   a. Direct-drive arrangement.
   b. Multiple fans connected to a common motor shaft and driven by a single motor.
   c. Materials: Non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 7.
3. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top of unit cabinet.

H. Unit Accessories:

1. Remote Room digital programable wall mounted thermoset:

2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

   a. Unit inlet air temperature.
   b. Coil entering refrigerant temperature.
   c. Coil leaving refrigerant temperature.

4. Field-Customizable I/O Capability:

   a. Analog Inputs: Four for use in customizable control strategies.
   b. Digital Inputs: Four for use in customizable control strategies.
   c. Digital Outputs: Four for use in customizable control strategies.

5. Features and Functions:

   a. Self-diagnostics.

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b. Time delay.
c. Auto-restart.
d. External static pressure control.
e. Auto operation mode.
f. Manual operation mode.
g. Filter service notification
h. Power consumption display.
i. Drain assembly high water level safety shutdown and notification.
j. Run test switch.

6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways.

2.6 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.

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4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 7.
3. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top /front face of unit cabinet.

H. Unit Accessories:
1. Remote Room digital programable wall mounted thermoset:
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

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I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature Coil entering refrigerant temperature Coil leaving refrigerant temperature.
4. Field-Customizable I/O Capability:

   a. Analog Inputs: Four for use in customizable control strategies.
   b. Digital Inputs: Four for use in customizable control strategies.
   c. Digital Outputs: Four for use in customizable control strategies.

5. Features and Functions: Self-diagnostics, time delay, auto-restart , auto operation mode , manual operation mode , filter service notification , drain assembly high water level safety shutdown and notification , run test switch.
6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.7 INDOOR, RECESSED, CEILING-MOUNTED CASSETTE UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

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C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Internal Tubing: Copper tubing with brazed joints.
6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:

1. Fan(s):

   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7.
3. Media:

   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.

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1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.

    a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
    b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.

2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in center of unit cabinet.

I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.

J. Unit Accessories:
1. Remote Room digital programable wall mounted thermoset:

K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature Coil entering refrigerant temperature Coil leaving refrigerant temperature.
4. Field-Customizable I/O Capability:

    a. Analog Inputs: Four for use in customizable control strategies.
    b. Digital Inputs: Four for use in customizable control strategies.
    c. Digital Outputs: Four for use in customizable control strategies.

5. Features and Functions: Self-diagnostics, time delay, auto-restart , auto operation mode , manual operation mode , filter service notification , drain assembly high water level safety shutdown and notification , run test switch.
6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.

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5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.8 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.
4. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve with 2000 positions for independent control.
5. A single system shall provide for up to 64 zones.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.

   a. Coating with documented salt spray test performance of 1000 hours according ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turn down from 100% to 3% percent of rated capacity.
2. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
3. Protection: Integral protection against the following:

   a. High refrigerant pressure.
   b. Low oil level.
   c. High oil temperature.
   d. Thermal and overload.
   e. Voltage fluctuations.
   f. Phase failure and phase reversal.
   g. Short cycling.

4. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.

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5. Vibration Control: Integral isolation to dampen vibration transmission.
6. Oil management system to ensure safe and proper lubrication over entire operating range.
7. Crankcase heaters with integral control to maintain safe operating temperature.
8. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

   a. Casing: Aluminum, galvanized, or stainless steel.
   b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
   c. Tubes: Copper, of diameter and thickness required by performance.
   d. The fins are to be covered with an anti-corrosion coating as standard with a salt spray test rating of 1000hr.
   e. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
   f. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for bottom plate heater. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation enhancing the defrost operation.
2. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

   a. Direct-drive arrangement.
   b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
   c. Statically and dynamically balanced.
   d. Multiple speed operation via a DC (digitally commutating) inverter.
   e. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.
7. Autocharging – Each system shall have a refrigerant auto-charging function.
8. Defrost Heating – Multiple condenser VRV systems shall maintain continuous heating during defrost operation. Reverse cycle (cooling mode) defrost operation shall not be permitted due to the potential reduction in space temperature.

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9. Oil Return Heating – Multiple condenser VRV systems shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
10. Low Ambient Cooling – Each system shall be capable of low ambient cooling operation to -4°F DB.
11. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve for independent control.
12. Oil Return – Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle
13.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

   a. Refrigerant suction temperature.
   b. Refrigerant discharge temperature.
   c. Outdoor air temperature.
   d. Refrigerant high pressure.
   e. Refrigerant low pressure.
   f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode , manual operation mode , night setback control , power consumption display , run test switch equalize run time between multiple same components.
5. Communication: Network communication with indoor units and other outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. VFD Inverter Control and Variable Refrigerant Temperature – Each condensing unit shall use high efficiency, variable speed all “inverter” compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.
9. Indoor units shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.
10. Software configuration – Each system shall be available with configurator software package to allow for remote configuration of operational settings and also for assessment of operational data and error codes. If this software is not provided by an alternate manufacturer, for each individual outdoor unit the contractor shall do the settings manually and keep detailed records for future maintenance purpose.

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11. Advanced Diagnostics – Systems shall include a self diagnostic, auto-check function to detect a malfunction and display the type and location.
12. Advanced Controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor units.
13. Each system shall be capable of integrating with open protocol BACnet and LonWorks building management systems. Provide optional controllers as required to integrate with building automation system
14. Simple Wiring – Systems shall use 16/18 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
15.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.
7. Voltage Platform –Heat recovery condensing units shall be available with a 208-230V/3/60 power supply.
8. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.
9.

I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevention corrosion when exposed to salt spray test for 1000 hours according ASTM B117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.
6. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation.
7.

K. Flexible Design:
1. Systems shall be capable of up to 540ft (623ft equivalent) of linear piping between the condensing unit and furthest located indoor unit.
2. Systems shall be capable of up to 3,280ft total “one-way” piping in the piping network.

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3. Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the indoor units.
4. Systems shall be capable of up to 295ft from the first REFNET™ / branch point.
5. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit capacity.
6. Systems shall be capable of 98ft vertical separation between indoor units.
7. Condensing units shall be supported with a fan motor ESP up to 0.32". WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.

L. Low Sound Levels – Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).

2.9 HEAT RECOVERY CONTROL UNITS (HRCUs)(BRANCH SELECTOR BOX)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with each branch of the cool/heat selector box. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.
4. Branch selector boxes shall be located as shown on the drawing. The branch selector boxes shall have the capacity to control up to 290 MBH (cooling) downstream of the branch selector box. Each branch of the branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during defrost (multiple condenser systems), no heating impact during changeover and reduced sound levels. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

B. Cabinet:

1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

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D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least 2 branch circuit port(s) for future use.
4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.

    a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: .
4. Features and Functions: Self-diagnostics, fuse protection,.
5. Communication: Network communication with indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.

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5. Testing: Factory pressure tested and verified to be without leaks.

2.10 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A or manufacturer standard network. .
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

   a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
   b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.
   c. Integration shall include control monitoring scheduling change of value notifications.

4. Operator Interface:

   a. Operators shall interface with system and unit controls through the following:

      1) Operator interfaces integral to controllers.
      2) Owner-furnished PC connected to central controller(s).
      3) Web interface through web browser software.
      4) Integration with Building Automation System.

   b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

      1) On/off control.
      2) Temperature set-point adjustment.

B. Central Controller DCM601A71: intelligent Touch Manager iTM)

1. The intelligent Touch Manager (version 2.04) shall provide control for all VRV, indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of controlling a maximum or 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The intelligent Touch Manager shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

2. The controller wiring shall consist of a non-polar two-wire connection to the indoor unit at terminals F1F2 (out-out) of the outdoor unit. The intelligent Touch Manager is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s).

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3. The intelligent Touch Manager can be used in conjunction with the BRC1E73 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet interface, Lonworks interface, and Modbus adapter to control the same indoor unit groups. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each remote controller group associated with the intelligent Touch Manager. DIII-NET address can be set for one (1) indoor unit or each indoor unit in the remote controller group. No more than 2 remote controllers can be placed in the same group.

4. The intelligent Touch Manager shall be equipped with two RJ-45 Ethernet ports for 100 Mbps network communication to support interconnection with a network PC via the Internet, Local Area Network (LAN), or connection with a non-networked PC after completed installation.

5. Web access functions shall be available so that facility staff can securely log into each Intelligent Touch Manager via the PC's web browser to support monitoring, scheduling, error recognition, and general user functions. Error emails are also sent to designated email addresses. An additional optional software function Power Proportional Distribution (PPD) tenant billing shall also be available. The optional software shall require advanced purchase and can only be activated upon receipt of a license activation key from Daikin AC.

6. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
7. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

8. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
9. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
10. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
11. Service diagnostics tool.
12. Able to disable and enable operation of individual controllers for indoor units.
13. Information displayed on individual controllers shall also be available for display through central controller.
14. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.
15. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
16. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

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C. Wired Controllers for Indoor Units: **Controller BRC2A71**

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD 4.75” x 2.75” in size: Timeout duration shall be adjustable.
3. Multiple Language: English
4. Temperature Units: Fahrenheit and Celsius.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between.
10. Relative Humidity Display: 1 percent increments.
11. Fan Speed Setting: Select between available options furnished with the unit.
12. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
13. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
14. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
15. Occupancy detection.
16. Service Notification Display: "Filter".
17. Service Run Tests: Limit use by service personnel to troubleshoot operation.
18. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
19. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
20. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
21. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.11 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

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2.12 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing: **(used in plenums)**

1. Drawn-Temper Tubing: According to ASTM B88, Type m according to ASTM B306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux according to ASTM B813.

C. CPVC plastic pipe according to ASTM F441/F441M, Schedule 40, with socket-type pipe fittings according to ASTM F438 and solvent cement according to ASTM F493. **(not used in plenums)**

D. PVC plastic pipe according to ASTM D1785, Schedule 40, with socket-type pipe fittings according to ASTM D2466 and solvent cement according to ASTM D2564, primer according to ASTM F656. **(not used in plenums)**

E. Comply with requirements in Section 232113 "Hydronic Piping" for system piping requirements.

2.13 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: ASTM B280, Type ACR or type L copper as per manufactures requirements.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

C. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: Dehydrated air or nitrogen.

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

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E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.14 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

2.15 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Zinc-coated or stainless steel.

2.16 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

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C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.17 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 1/2 inch thick.
c. Outdoors: 1/2 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: None required.
c. Outdoors, Exposed to View: None required.

C. Refrigerant Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
b. Indoors: 1 inch thick.
c. Outdoors: 1 inch thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: None required.
c. Outdoors, Exposed to View: .PVC, color selected by Architect, 20 mils thick

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

2.18 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

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a. Flame Travel Distance: 60 inches or less.
b. Peak Optical Smoke Density: 0.5 or less.
c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: Comply with NFPA 262.

C. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.

a. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. PVC insulation.
c. Unshielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated Cable: NFPA 70, Type CMP.

a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. Fluorinated ethylene propylene insulation.
c. Unshielded.
d. Fluorinated ethylene propylene jacket.

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e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: NFPA 262.

D. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.19 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

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

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

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 products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

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D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Floor-mounted units located in mechanical rooms.

J. Install floor-mounted units on support structure indicated on Drawings.

K. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

L. Attachment: Install hardware for proper attachment to supported equipment.

M. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

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B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

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4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF HYDRONIC PIPING

A. Install continuous-thread hanger rods and elastomeric spring hangers of size required to support equipment weight for hanging equipment

B. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

3.8 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

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F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

3.9 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

C. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

D. Fastener System Installation:

1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

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E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

L. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

M. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:

1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.

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3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

N. Vertical-Piping Clamps: Install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

O. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 10 feet.

P. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

Q. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

R. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

S. Trim excess length of continuous-thread hanger and support rods to 1 inch.

T. Hanger-Rod Attachments: Install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

U. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

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10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.10 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

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3.11 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
2. Locate nameplate or label where easily visible.

E. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

F. Install manufactured conduit sweeps and long-radius elbows if possible.

G. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.12 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

a. Within equipment and associated control enclosures.
b. In accessible ceiling spaces where open cable installation method may be used.
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

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4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.13 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

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B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.14 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.15 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."

B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.16 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.

2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

3. Site Visits: Activities for each site visit shall include the following:

a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.

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b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
e. Issue a report for each visit, documenting the visit.

1) Report to include name and contact information of individual making the visit.
2) Date(s) and time frames while on-site.
3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

4. Final Inspection before Startup:

a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.

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18) Unit airflow direction within an acceptable range.
19) If applicable, fan external static pressure setting.
20) Filter type and condition acceptable.
21) Noise level within an acceptable range.
22) Refrigerant piping properly connected and insulated.
23) Condensate drain piping properly connected and insulated.
24) If applicable, ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.

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17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Refrigerant piping properly connected and insulated.
22) Condensate drain piping properly connected and insulated.
23) Automatic dampers properly installed and operating.
24) Ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

g. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
h. Installer shall correct observed deficiencies found by the inspection.
i. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
j. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
k. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.

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b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.

D. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

E. Products will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.17 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

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C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.

a. All available system operating parameters shall be included in the information submitted.

3.18 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.19 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

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3.20 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include two service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.21 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

3.22 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.

C. Schedule and Duration:
1. Training shall occur before Owner occupancy.

D. Training Attendees: Assume owner representative people.

E. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

F. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

G. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

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H. Acceptance: Obtain engineer written acceptance that training is complete, and requirements indicated have been satisfied.

END OF SECTION 238129

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SECTION 238239.13 - CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and hot-water**, and** electric-resistance heating coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. DDC: Direct digital control.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of piping valves and specialties.
7. Indicate location and arrangement of integral controls.
8. Wiring Diagrams: Power, signal, and control wiring.

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

D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which cabinet unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ductwork

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Unit-Heater Filters: Furnish **one** spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design; Indeeco, Vulcan, Markel.

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B. Manufacturers: Subject to compliance with project requirements and review and approval by the Engineer products by one of the following may be used:

C.
1. Modine
2. Rittling
3. Vulcan
4. Sterling

2.2 DESCRIPTION

A. Factory-assembled and -tested unit complying with AHRI 440.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Electric cabinet unit heaters shall comply with UL 2021.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.4 COIL SECTION INSULATION

A. Insulation Materials: ASTM C 1071; surfaces exposed to airstream shall have aluminum-foil facing to prevent erosion of glass fibers.

1. Thickness: 1 inch.
2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Alternative Insulation Materials: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.

1. Thickness: 1 inch.
2. Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
4. Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

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5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.5 CABINETS

A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect or baked-enamel finish with manufacturer's custom paint, in color selected by Architect. Refer to schedule submit color chart for review and approval.

1. **Vertical Uni**t; Exposed Front Panels: Minimum 0.0528-inch- thick galvanized sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
2. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
3. **Recessed Uni**t; Flanges: Steel, finished to match cabinet.
4. Control Access Door: Key operated.
5. **Vertical, wall-mounted units;** Base, minimum 0.0528-inch-thick steel, finished to match cabinet, 4 inches or 6 inches high with leveling bolts.
6. Extended Piping Compartment: 8-inch- wide piping end pocket.
7. **Vertical Unit Accessories;**
   a. False Back: Minimum 0.0428-inch-thick steel, finished to match cabinet.
   b. Outdoor-Air Wall Box: Minimum 0.1265-inch-thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen; aluminum louver with anodized finish in color selected by Architect from manufacturer's standard or custom colors.

2.6 FILTERS

A. Minimum Arrestance: And a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Washable Foam: 70 percent arrestance and MERV 3.
2. Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV 5.
3. Pleated: 90 percent arrestance and MERV 7.

2.7 COILS

A. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

B. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

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2.8 CONTROLS

A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
4. Wall or unit mounted thermostat as indicated on plan and equipment notes and schedules. Manufactures optional thermostats shall be capable of fan on off auto, and set point adjustment.

B. Factory, Hot-Water Piping Package: ASTM B 88, Type L, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Three-way, two-position control valve

2. Hose Kits: steel braided flexible connection, minimum 200-psigworking pressure, and operating temperatures from 33 to 211 deg F Tag hose kits to equipment designations.

   a. Length: 6”
   b. Minimum Diameter: Equal to cabinet unit-heater connection size.

3. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psigminimum CWP rating and blowout-proof stem.
4. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psigworking pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
5. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psigminimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2threaded pipe and full-port ball valve in strainer drain connection.
6. Wrought-Copper Unions: ASME B16.22.

C. Basic Unit Controls:

1. Control voltage transformer.
2. Wall **or** Unit-mounted thermostat with the following features:

   a. Heat-off switch, with temperature set point adjustment
   b. Fan on-auto switch.
   c. Manual fan-speed switch.
   d. Adjustable deadband.
   e. Concealed set point.
   f. Deg F indication.

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3. Wall or Unit-mounted temperature sensor.
4. Unoccupied period override push button.
5. Data entry and access port.

   a. Input data includes room temperature and occupied and unoccupied periods.
   b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

D. Electrical Connection: Factory-wired motors and controls for a single field connection.

2.9 CAPACITIES AND CHARACTERISTICS.

A. Capacities are as scheduled on plan

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. vertical, wall-mounted cabinet unit heaters with wall boxes and outdoor-air intake louvers.
   1. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Suspend cabinet unit heaters from structure with elastomeric hangers.

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

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3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 "Hydronic Piping Specialties," Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping to allow service and maintenance and access to valves and specialties.

C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Section 233300 "Air Duct Accessories." If applicable.

E. Hot water cabinet unit heaters shall comply with safety requirements in UL 1995.

F. For hot water cabinet unit heaters, unless otherwise indicated, install union, strainer and ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. For electric units operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

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3.6 DEMONSTRATION

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

END OF SECTION 238239.13

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SECTION 238316 – RADIANT HEATING SYSTEM PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes radiant-heating piping, consisting of pipes, fittings, and piping specialties including:

1. PEX pipe and fittings.
2. Piping specialties.
3. Distribution manifolds and compatible fittings.
4. Fasteners approved by manufacturer.
5. Mixing assemblies.
6. Controls.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PEX: Crosslinked polyethylene.

C. PTFE: Polytetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for piping, fittings, manifolds, specialties, and controls; include pressure and temperature ratings, oxygen-barrier performance, fire-performance characteristics, and water-flow and pressure-drop characteristics.

B. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.

1. Shop Drawing Scale: **1/4 inch = 1 foot**
2. Shop drawings and calculation reports with the following information:

a. Submit circuit layout that shows manifold location, pipe spacing, pipe size, circuit length, flow rates, head loss, supply water temperatures for heating, and supply water temperatures for cooling if applicable.

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b. Provide calculation reports that show output of the heating/cooling system to include any excess or shortages of heating or cooling, heating/cooling entering the space, flow rates, head loss, back losses of heating/cooling, floor covering resistance, and floor surface temperatures.
c. Submit floor cross section details with fastener(s) being used, fastener spacing, insulation requirements, thermal mass thickness (if required), and intended floor covering.
d. Submit details of manifold, manifold cabinets, valves, and fittings either in a flush mounted installation or a recessed location.
e. Submit details of slab penetrations.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which radiant-heating piping will be attached.
3. Expansion joints and slab penetrations.
4. All footings, floor drains, lifts and other items in the slab

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For radiant-heating piping valves and equipment to include in operation and maintenance manuals.

B. Technical data sheets.

C. Product instructions.

D. Design calculation reports.

1.7 WARRANTY

A. Manufacturer warranty shall include the following:

1. In the event that manufacturer determines that the failure or leak and any resulting damages were the result of a manufacturing defect in the products covered by the warranty and occurred during the first ten years of the time period covered by the warranty, the manufacturer will reimburse the property owner for reasonable repair or replacement charges resulting from the failure or leak and, additionally will reimburse damages to personal property resulting from the failure or leak.
2. Radiant heat pipe manufacturer shall warranty the tubing under normal conditions of use and properly maintained, will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of installation, when properly installed by contractors trained by manufacturer.

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3. PEX Press fittings, when installed with ViegaPEX Barrier and FostaPEX tubing, will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of installation. This also includes protected PEX Press fitting in a slab.
4. Manifolds and panels used in the system will be free from manufacturing defect for a period of five (5) years.
5. Controls, mixing stations, or electrical components sold by manufacturer shall be free from manufacturing defect for a period of two (2) years from date of installation.

PART 2 - PRODUCTS

2.1 PEX PIPE AND FITTINGS

A. Basis-of-Design Product: LLC;Viega

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:

1. The FlorHeat Company.
2. Heat Innovations Inc.
3. Infloor Radiant Heating Inc.
4. IPEX USA LLC.
5. Uponor

C. Pipe Material:

1. PEX tubing and fittings shall maintain a quality control program in accordance with ISO 9001 or NSF International in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard.
2. Tubing shall be silane cross-linked high density polyethylene as per ASTM F876/F877 and CSA B137.5.
3. Tubing includes four layers.

   a. First layer: Cross-linked, high density polyethylene.
   b. Second layer: Adhesive.
   c. Third layer: Ethylene vinyl alcohol layer (EVOH oxygen barrier).
   d. Fourth layer: Polyethylene to protect the EVOH layer from damage.

4. Certified to NSF 14 and 61.
5. Tubing will have 6 month UV protection.
6. Certified to UL 263 ULC S101 for floor and wall assemblies.
7. Certified to ASTM E84 and ULC S102.2 Flame Spread (FS)/Smoke Developed (SD) (25/50).

D. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 deg F according to DIN 4726.

E. Bronze Fittings: PEX Press Fittings manufactured from UNS C83600 copper alloy, meeting the requirements of ASTM F 877 tested as a system with Viega PEX Barrier tubing.

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1. PEX Press Sleeve: Manufactured out of a 304 grade or better stainless steel and have three view holes with an attached sleeve to ensure proper PEX tubing insertion.
2. Attached sleeve fitting will incorporate a tool locator ring that shall be in place while making a proper press connection.
3. PEX Press connection shall be made with a Viega supplied ratcheting PEX Press hand tool or PEX Press power tool.

F. Polymer Fittings: PEX Press Fittings manufactured from Radel-R® polymer, meeting the requirements of ASTM F 877 tested as a system with ViegaPEX Barrier tubing.

1. PEX Press Sleeve: Manufactured out of a 304 grade or better stainless steel and have three view holes with an attached sleeve to ensure proper PEX tubing insertion.
2. Fitting will include the Smart Connect feature providing quick easy identification of unpressed connections during the pressure testing process.
3. Unpressed connections are located by pressurizing the system to 0.5 psi to 100 psi.
4. Attached sleeve fitting will incorporate a tool locator ring that shall be in place while making a proper press connection.
5. PEX Press connection shall be made with a Viega supplied ratcheting PEX Press hand tool or PEX Press power tool.

G. Pressure/Temperature Rating: ViegaPEX Barrier High-Density Cross-linked polyethylene tubing shall meet the standard grade hydrostatic pressure ratings from the Plastic Pipe Institute in accordance with TR-4/03. The following three ratings are required:

1. 200 deg F at 80 psi.
2. 180 deg F at 100 psi
3. 73.4 deg F at 160 psi.

2.2 DISTRIBUTION MANIFOLDS

A. Stainless Manifolds with Balancing Valves: Minimum NPS 1 1/4.

1. Manifolds shall be made of 304 stainless steel with nickel-plate valve necks on select models.
2. Balancing valves and shut off valves are integrated on manifold.
3. Air bleeders and purge valves are to be integrated on manifold.
4. Manifolds have 1 inch NPT removable end caps and 1 1/4 inch NPT Union connections.
5. Use bracket supplied by Viega.
6. Select manifold cabinet based on manifolds, accessories and fittings added.
7. Accept optional powerheads for individual zone control.
8. Manifold circuit connections are suitable to receive all SVC connections.
9. Maximum Operating Pressure: 100 psi .
10. Maximum Operating Temperature: 180 deg F.
11. Thermometers:

    a. Mount on connection.
    b. Case: Stainless steel, 2 inch diameter.
    c. Element: Bimetal coil element.
    d. Movement: Mechanical, connecting element and pointer.
    e. Dial: White aluminum, black lettering.

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f. Pointer: Aluminum, black.
g. Window: Instrument glass, NS 33 polycarbonate.
h. Connector: Rigid, back type.
i. Accuracy: Plus or minus 2 percent of range.

B. Balancing Valves for Stainless Manifolds:

1. Body: Brass, nickel plated.
2. Valve Spindle: Brass, EPDM.
3. Inlet Connection: NPS 1/2, 1/2 inch with O-ring.
4. Operator: Allen Wrench - 5 mm.
5. CWP Rating: 145 psi.
6. Maximum Operating Pressure: 100 psi .
7. Maximum Operating Temperature: 180 deg F .

C. Manual Air Vents:

1. Body: Brass, nickel-plated.
2. Operator: Key furnished with valve, or screwdriver bit.
3. Inlet Connection: NPS 1/2 .
4. Maximum Operating Pressure: 100 psi .
5. Maximum Operating Temperature: 180 deg F .

D. Main Shutoff Valves for Stainless Manifolds:

1. Field installed on supply and return connections.
2. Two-piece body.
3. Body: Brass nickel-plated body.
4. Ball: Full port chrome-plated brass.
5. Seals: PTFE.
6. Stem: Brass with 2 Buna-N O-rings and blowout proof assembly.
7. CWP Rating: 100 psig .
8. Maximum Operating Temperature: 180 deg F.

E. Powerheads (valve operator) for Stainless Manifolds (0-10 VDC): (not used)

1. Voltage: 24 VAC 50/60 Hz.
2. Control Voltage: 0-10 VDC.
3. Maximum Inrush Current: < 320 mA for 2 minutes maximum.
4. Operating Power 1 watt.
5. Actuating Force: 21 lbs
6. Stroke: 0.16 inch .
7. Fluid Temperature: 32 to 212 deg F.
8. Max Pressure Differential: 50 psi
9. Connecting Cable Length: 3 feet.

2.3 PIPING SPECIALTIES

A. Cable Ties:

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1. Self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
2. Minimum Width: 0.17 inch.
3. Tensile Strength: 75 lb, minimum.

2.4 PREASSEMBLED STATIONS

A. Basis-of-Design Product: LLC;Viega

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:

1. The FlorHeat Company.
2. Heat Innovations Inc.
3. Infloor Radiant Heating Inc.
4. IPEX USA LLC.
5. Uponor

C. Hydronic 3- Way Mixing Valve station;

1. Input Voltage/Current: 120 VAC ± 10% 60 Hz, 2A.
2. Sensors: (2) 10 K Ohms - 1 boiler sensor, 1 outdoor sensor.
3. Boiler Relay: 24 VAC 1.0 MAX AMPS.
4. Circulator Relay: 24 VAC 1.0 MAX AMPS.
5. Microprocessor: 8 Bit, 32 MHz.
6. Maximum Temperature: 203 deg F.
7. Pressure:

    a. Maximum Working Pressure: 45 psi
    b. Maximum Test Pressure: 100 psi

8. Weight: 10 lbs
9. Dimensions: 12.18 inches W x 10 inches H x 6.7 inches D
10. Listings:

    a. Meets CSA C22.2 No. 24.
    b. Meets UL Standard 873.
    c. ETL Control No. 3068143.

D. Hydronic 3 - way Valve Mixing Station with Circulator: (not used)

1. Enhanced Mixing Station Maximum Operating Pressure: 100 psi.
2. Enhanced Mixing Station Maximum Operating Temperature: 180 deg F
3. Connecting Options: Viega PEXPress, ProPress or Copper.
4. Mixing Station Piping Material: Type L Copper, ASTM B 88.
5. Circulator:

    a. Circulator Material: Cast iron.
    b. Circulator Flow Range: 0 - 17.5 U.S. GPM
    c. Circulator Head Range: 0 - 19 ft.
    d. Circulator Motor: Permanently magnetized circulator motor, Single Phase, 120 V.

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e. Circulator Temperature Range: 36 to 230 deg F
f. Circulator Settings: 7 settings, 3 fixed speeds, 3 constant pressures, and 1 AutoADAPT™.
g. Circulator Maximum Discharge Pressure: 150 psi

6. Diverting Valve:

a. Diverting Valve Body: Bronze.
b. Diverting Valve Seals: EPDM.
c. Diverting Valve Maximum Differential Pressure: 7.3 psi
d. Diverting Valve Cv 7.6.

7. Ball Valve:

a. Ball Valve: Two piece bronze body.
b. Ball Valve Ball: 316 stainless steel ball, full port.
c. Ball Valve Seals: EPDM sealing elements.
d. Ball Valve Stem Seals: EPDM.
e. Ball Valve Press Ends: With engineered leak path.
f. Ball Valve Operating Temperature: 0 to 250 deg F
g. Ball Valve Maximum Operating Pressure: 200 psi
h. Ball Valve: 600 WOG.
i. Ball Valve Handles: Metal with standard sticker indicators for supply and return.

E. Hydronic 3-way mixing Valve Station with High Head Circulator: field assembled

1. High Head Mixing Station Maximum Operating Pressure: 100 psi.
2. High head Mixing Station Maximum Operating Temperature: 180 deg F
3. Connection Options: Viega PEX Press, ProPress or Copper.
4. Mixing Station Piping Material: Type L Copper, ASTM B 88.
5. Circulator:

a. Circulator Material: Cast iron.
b. Circulator Flow Range: 0 - 34 U.S. gpm.
c. Circulator Head Range: 0 - 30 ft
d. Circulator Motor: 2 Pole, Single Phase, 120 V.
e. Circulator Temperature Range: 36 to 230 deg F.
f. Circulator Maximum Working Pressure: 145 psi
g. Circulator Settings: 3 Speeds.

6. Diverting Valve:

a. Diverting Valve Body: Bronze.
b. Diverting Valve Seals: EPDM.
c. Diverting Valve Maximum Differential Pressure: 7.3 psi
d. Diverting Valve Cv: 7.6.

7. Ball Valve:

a. Ball Valve: Two piece bronze body.

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b. Ball Valve Ball: 316 stainless steel ball, full port.
c. Ball Valve Seals: EPDM sealing elements.
d. Ball Valve Stem Seals: EPDM.
e. Ball Valve Press Ends: with engineered leak path.
f. Ball Valve Operating Temperature: 0 to 250 deg F.
g. Ball Valve Maximum Operating Pressure: 200 psi.
h. Ball Valve 600 WOG.
i. Ball Valve Handles: Metal with standard sticker indicators for supply and return.

2.5 CONTROLS

A. Basis-of-Design Product: LLC;Viega. Al controls shall be by the manufacture of the radiaent products listed above.

B. The Viega Basic Heating Control is designed to control the supply water temperature to a hydronic system in order to provide outdoor reset operation. The Basic Heating Control uses a floating action actuator mounted on a diverting or mixing valve to regulate the supply water temperature. The control has a Liquid Crystal Display (LCD) to view system status and operating information.
1. Additional functions include:
2. User comfort adjustment to increase or decrease building space temperature
3. Advanced settings to fine-tune building requirements
4. Optional indoor sensor for room air temperature control (Part Number 16016)
5. Test sequence to ensure proper component operation
6. 120 VAC power supply
7. Powered system circulator pump output
8. CSA C US certified (approved to applicable UL standards)
9. Remote sensor unit with adjustable temperature range from minus 40 to 248 deg F.
10. Snap action; open-on-rise, 2 SPDT dry contacts, 1/2 hp @ 120 VAC, 9.8 FLA, 58.8 LRA.
11. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing radiant-pipe temperature.
12. Corrosion-resistant, waterproof control enclosure.

C. Sequence of Operation:

1. Boiler operation shall be enabled by the radiant floor controller panel, RFCP. Contacts in the panel shall close on a call for heat based on outside air temperature. Provide an outside air temperature sensor arranged to be connected to the RFCP.
2. Once enabled, the boiler shall be arranged to operate through the built-in factory digital display controller located on the boiler.
3. Hot water temperature setpoint shall be maintained in accordance to a reset schedule. At 55 deg F the water temp shall be 90 deg F. At 0 deg F the HW temp shall be 150 deg F.
4. The RFCP shall also enable the primary circulator pump to run when the boiler is enabled.
5. The RFCP shall also enable each secondary circulator pump for each of two zones of radiant heat based on a local room temperature sensor/thermostat. The zone temperature set point shall be set to 76 deg F adjustable. When the space temperature drops blow set point, the circulator shall start.

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6. The 3-way mixing valves shall be arranged to mix HWS to each of the two zones based on based on space temperature.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive radiant-heating piping for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Ensure that surfaces and pipes in contact with radiant-heating piping are free of burrs and sharp protrusions.
2. Ensure that surfaces and substrates are level and plumb.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of radiant-heating piping for the applications described:
1. Piping in Interior Reinforced-Concrete Floors: ViegaPEX Barrier.

3.3 INSTALLATION

A. Refer to manufacturer's most current installation instructions.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings or coordination drawings.

C. Install ViegaPEX Barrier at least 4 inches from edge of slabs, walls or other permanent objects.

D. Install ViegaPEX Barrier continuous from the manifold through the heated floor and back to the manifold without piping joints in heated panels. If coupling is required, use Viega PEX Press fitting and wrap in Viega's Coupling Repair Tape.

E. Avoid crossing tubing in slab unless minimum concrete thickness is met.

F. Square off ViegaPEX Barrier with approved PEX Cutters.

G. Connect ViegaPEX Barrier to manifold using approved Viega Manifold Adapters.

H. Use bend supports for pipe entering and exiting the slab.

I. Do not bend pipes in radii smaller than manufacturer's minimum bend radius.

J. Manifolds should be installed with brackets supplied by Viega LLC.

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K. Install manifolds in accessible locations, or install access panels to provide maintenance access as required in Section 083113 "Access Doors and Frames."

L. Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties" for pipes and connections to hydronic systems and for glycol-solution fill requirements.

M. Fire- and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials according to Section 078413 "Penetration Firestopping."

N. Piping in Interior Reinforced-Concrete Floors:

1. Secure piping by attaching pipes to reinforcement using approved fasteners from manufacturer.
2. Space fasteners a maximum of 24 inches and at center of turns and bends.
3. Maintain 2 inch minimum cover.
4. Install vapor barrier and insulation as per the radiant design. Ensure compression rating is suitable for structural engineer.
5. If pipe is being secured to insulation space fasteners a maximum of 24 inches and at center of turns and bends.
6. Install a sleeve of 3/8 inch thick, foam-type insulation PVC or PE pipe around tubing and extending for a minimum of 12 inches on each side of slab expansion joints to protect the tubing passing through expansion joints. Anchor sleeve to slab form at expansion joints to provide maximum clearance for saw cut.
7. If tube passes metal expansion joints pass tubing under the joint.
8. Maintain pressure test of a minimum 100 psig or 1.5 times system working pressure.
9. After initial pressurization, ensure pressure has not dropped after 20 minutes. Fluctuations may occur due to temperature fluctuations and tubing expansion. If a drop has occurred add pressure to the system. Carry out testing for a minimum of 1 hour.
10. Maintain pressure in piping during concrete and floor covering installation and continue for 24 hours after placement.

O. Piping in Concrete Floor (Not Reinforced):

1. Secure piping in concrete floors by attaching pipes to subfloor using approved fastener from manufacturer.
2. Space approved fasteners from manufacturer a maximum of 24 inches o.c. and at center of turns or bends.
3. Maintain 3/4 inch minimum cover.
4. Install insulation as per radiant design.
5. Install a sleeve of 3/8 inch-thick, foam-type insulation PVC or PE pipe around tubing and extending for a minimum of 12 inches on each side of slab expansion joints to protect the tubing passing through expansion joints. Anchor sleeve to slab form at expansion joints to provide maximum clearance for saw cut.
6. Maintain pressure test of a minimum 100 psig or 1.5 times system working pressure.
7. After initial pressurization, ensure pressure has not dropped after 20 minutes. Fluctuations may occur due to temperature fluctuations and tubing expansion. If a drop has occurred add pressure to the system. Carry out testing for a minimum of 1 hour.

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8. Maintain pressure in piping during concrete and floor covering installation and continue for 24 hours after placement.

P. Piping in Ceiling:

1. Secure piping by attaching pipes to ceiling substrate using clamps or staples.
2. Space clamps or staples a maximum of 24 inches o.c. and at center of turns or bends.
3. Maintain 1-1/2-inch minimum thermal mass cover.
4. Maintain pressure test of a minimum 100 psig or 1.5 times system working pressure.
5. After initial pressurization, ensure pressure has not dropped after 20 minutes. Fluctuations may occur due to temperature fluctuations and tubing expansion. If a drop has occurred add pressure to the system. Carry out testing for a minimum of 1 hour.
6. Maintain pressure in piping during concrete and floor covering installation and continue for 24 hours after placement.

Q. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved by Architect.

R. After system balancing has been completed, mark balancing valves to permanently indicate final position per design.

S. Perform the following adjustments before operating the system:

1. Open valves to fully open position.
2. Check operation of automatic valves.
3. Set temperature controls so all zones call for full flow.
4. Purge air from piping.

T. After concrete has cured, operate radiant-heating system as follows:

1. Start warm up after concrete has reached its final set (curing complete).
2. Set supply water temperature to 75 deg F for the first three days.
3. Increase supply water temperature to the set point in gradual increments for the next 4 days. Maximum of a 50 deg F increase in a period of 24 hour).

3.4 FIELD QUALITY CONTROL

A. Prepare radiant-heating piping for testing as follows:

1. Open all isolation valves and close bypass valves.
2. Open and verify operation of zone control valves.
3. Flush with clean water and clean strainers.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig. Repair leaks and retest until no leaks exist.

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2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Radiant-heating piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Protect hydronic piping system from damage during construction.

END OF SECTION 238316

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SECTION 23 84 16 VEHICLE EXHAUST SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.03 SYSTEM DESCRIPTION

A. This system shall be the Sliding Balancer Track System, (SBT), and shall include the following;
   1. Furnish, installation, programming, start up and commissioning of the Back-in type vehicle exhaust systems.
   2. (8) SER-850-AD Hose Reels with trolleys.
   3. (8) aluminum profile exhaust rails. (8) at approximately 26' long.
   4. (2) vehicle exhaust fans VEF-1, VEF-2.
   5. VFD's with pressure sensor and pitot tube for each fan
   6. Wireless Receivers and Transmitters for startup of each fan.
   7. Mounting brackets and hardware
   8. Magnetic and overhead stack extractors and adaptors.

1.04 SUBMITTALS

A. Product Data: Indicate manufacturer's model number, technical data, accessories, requirements for access, maintenance, weights and service-connections including dimensions.

B. Contractor to provide layout drawings showing field locations of all rails, hose reels, duct diameters and hanger details.

C. Closeout Submittals: Operation and Maintenance data manual including spare parts list.

1.05 QUALITY ASSURANCE

A. Engage an experienced installer to perform work of this Section who has specialized in installing hose storage systems, who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance for a minimum of five years.

B. Engage a firm experienced in manufacturing hose storage systems similar to that indicated for this Project and with a record of successful in-service performance.

C. Conduct conference at Project site. Review methods and procedures related to hose storage system installation.
   1. Review access requirements for equipment delivery.
   2. Review equipment storage and security requirements.
   3. Inspect condition of preparatory work performed by other trades.
   4. Review structural loading limitations.

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1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver hose storage system as a factory assembled unit with protective crating and covering. Store equipment in original protective crating and covering and in a dry location.

1.07 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify dimensions installation areas by field measurements.

1.08 COORDINATION

A. Coordinate layout and installation with other work, including light fixtures, HVAC equipment, overhead cranes, owner's representative and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

C. Confirm product locations with owner's representative prior to installing equipment.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Basis of design: Plymovent Corporation.

B. Subject to compliance with project requirements, and review and approval by the Engineer provide a comparable product by one of the following:
1. Monoxivent
2. Eurovac
3. Fume-A-vent

C. SCOPE OF WORK:

The project is for the installation of a Plymovent magnetic type source capture exhaust removal system or approved equal. The project consists of eight (8) vehicle connections and two (2) exhaust fans with auto start controllers according to the specifications to follow.

Shall be delivered and installed as a magnetic Sliding Balancer Track system. This type of system is designed for vehicles with under carriage exhaust tailpipe configurations. It will handle one apparatus per bay with back-in configurations allowing the operator to attach the system at the vehicle entrance and reach its designated rest position. the system must be designed and capable of capturing virtually 100% of the exhaust gas and particulate at the tailpipe.

2.02 MANUFACTURED UNITS

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A. SCOPE OF WORK:

The project is for the installation of a Plymovent magnetic type source capture exhaust removal system or approved equal. The project consists of eight (8) vehicle connections and two (2) exhaust fans with auto start controllers according to the specifications to follow.

Shall be delivered and installed as a magnetic Sliding Balancer Track system. This type of system is designed for vehicles with under carriage exhaust tailpipe configurations. It will handle one apparatus per bay with back-in configurations allowing the operator to attach the system at the vehicle entrance and reach its designated rest position. the system must be designed and capable of capturing virtually 100% of the exhaust gas and particulate at the tailpipe.

B. SLIDING BALANCER TRACK

The track shall be 19 feet continuous in length without splices, have a maximum weight of 35 pounds and have a load capacity rating of 5800 pounds. Construction profile shall be of a box-lock type with cross sectional structural support for torsion reinforcement

C. TRACK MOUNTING COMPARTMENT

Shall accept 8” length slider bars, which are utilized to secure vertical support legs to the boxloc track and distribute the load across the top of the track. This method of attachment ensures an enduring fastening system in the event the track comes in contact with a moving vehicle or encounters an unforeseeable force.

D. MOUNTING SUPPORT LEGS

Support legs shall be provided for every 10’ of track length. Supports shall be constructed of 2”x2” x 1/8” wall thickness tube aluminum alloy to provide strength and keep total system weight to a minimum. Leg supports shall be a one piece construction. All leg supports shall have side bracing constructed from tubular zinc plated steel to provide stabilization of track system. Angle shall be completely adjustable to the leg support and mounted perpendicular to direction of track. Typical support angle shall be 45 degrees from center line of support. Refer to details on plan

E. TRACK SPLICE ASSEMBLY

In the event it is required to extend the length of track greater than its 19 foot continuous length, a track splice shall be provided. Track splice shall be manufactured of zinc plated steel in two parts as a clamp. This clamp shall accurately secure both tracks in a fashion which shall eliminate any possibility of problem passage through this splice. Connecting length of splice shall be a minimum of 15 ¾” long and fabricated of 14 gauge material. Four ¼” bolts with lock nuts shall pass directly through internal partition of box-lock track.

F. TRACK JOINER PLATE

In the event that it is necessary to join two tracks in a parallel configuration, a joiner plate shall be provided for proper support to both tracks and secure mounting to support leg assembly.

G. PRIMARY ENDSTOPS

Shall be installed inside the end of the track and fabricated of zinc plated steel in U-shape form with rubber endstop on the impact end of the endstop. It is attached by using a ¼” molded

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locking bolt. Endstop shall be secured to track with no less than (2) ¼" bolts and locking nuts located on the underside of the track.

H. DUCT/HOSE RISER BRACKET

The bracket, manufactured for the purpose of transitioning from flexible duct to solid spiral duct, shall be fabricated as a one-piece welded assembly. Riser bracket shall mount directly to the track to provide stabilization to duct system and provide support to the flexible hose. Connecting the duct system directly to the traveling hose assembly is unacceptable.

I. BALANCER BLOCK

A balancer shall be used to keep the hose off the floor and away from the vehicle. It shall be a self-adjusting weight balancer with a lifting capacity of no less than 37 Lbs. and provide a constant lifting force without locking in an extended position. Balancer shall have a minimum diameter stainless steel cable of .080 for the purpose of retracting the hose away from the vehicle upon release. A steel cable shall be used for strength and durability and shall not be substituted.

J. UPPER HOSE ASSEMBLY

The upper hose shall be 5" in diameter manufactured for the sole purpose of venting high temperature exhaust gases, which are produced by internal combustion engines. Due to the increased temperatures associated with vehicle regeneration filter cleaning the flexible hose shall be rated for 900 degrees (F) continuous, 1,050 degrees (F) intermittent temperatures. The outside of the exhaust hose shall have a protective lamination the entire length of the hose to protect fire apparatus in the event vehicle and hose come in contact with each other.

K. LOWER HOSE ASSEMBLY

Shall be a rigid 2 foot long section of hose identical in characteristics to the upper hose assembly. Lower hose shall support connection nozzle and reducing elbow in a rigid fashion as to allow for operator to place hose collection device onto tailpipe without bending over. Lower hose is the only section of hose which shall release in the event of safety disconnect.

L. SAFETY HANDLE DISCONNECT COUPLING

Incorporated in the design of the system shall be a safety breakaway device enabling a physical disconnect between the exhaust system and the vehicle in the event of system malfunction or human error. The devise shall incorporate a handle for attaching the system to the vehicle without bending over. The coupling will enable the lower two foot hose assembly to freely rotate 360 degrees. The device shall utilize a quick connect fitting so the lower hose can be snapped back into place without the use of any tools. The quick connect also allows the lower hose to be manually disconnected and relocated to any other system should the vehicle be relocated. This device shall be reusable and have an adjustable release tension of 20 – 206 Lbs. with a factory preset at 130 Lbs. Since this item is a point of safety for both personnel and the system itself, no exception may be taken to this feature.

M. HOSE SUSPENSION SADDLE

The hose saddle shall be fabricated of steel with a heat resistant protective paint. The saddle shall support the hose and serve as the stress point during the system release. The design of saddle shall join two sections of hose together at its midpoint intersection and provide a smooth 93 degree transition.

N. MAGNETIC NOZZLE &TRANSITION ELBOW

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The nozzle attachment shall be designed to mate up with the vehicle tailpipe in such a manor to prevent the operator from having to bend over to attach the nozzle. The connection shall be kept simple so the operator can attach the nozzle at any angle without having to align components to the vehicle. Simplicity of nozzle attachment will be determined by the fire department.

The nozzle will allow a sealed connection to the end of the tailpipe which is to be outfitted with a conical male adaptor designed for mating up with the nozzle. It is preferred the nozzle shall be fabricated from zinc plated steel and stainless steel for strength and malleability superior properties over aluminum. The nozzle shall also have the ability to add or subtract magnets from the nozzle thereby providing an adjustment capability for magnetic hold strength to the tailpipe conical adaptor. The manufacture offers the nozzle and tailpipe adaptor in 3”, 3.5”, 4”, 5”, 6” & 7” diameters to accommodate all tailpipe diameters and configurations. The shall order the current size based on field conditions

To ensure there is no leakage of exhaust, the magnetic connection shall be accomplished in such a manner that there is no gap between the vehicle tailpipe termination point and the nozzle connection to the tailpipe The earth magnets shall be adjustable and easily removable for replacement. They shall be positioned to hold the nozzle connection to the tailpipe while the vehicle is entering and exiting the station without releasing. The nozzle shall incorporate a debris screen to prevent foreign objects from entering the system and a 67 degree transition to direct the exhaust gasses up the hose. The exterior of the nozzle shall be chrome plated for corrosion resistance.

O. VEHICLE TAILPIPE CONFIGURATION

Tailpipe conical adaptors shall be provided for eight (8) apparatus. The adaptor shall be the same size as the vehicle tailpipe and allow the induction of ambient air into the nozzle. The tailpipe adaptor shall be constructed of corrosion resistant zinc plated steel with completely smooth edges to reduce grime accumulation. The fire department will be responsible for modifying the exhaust pipes per the manufactures suggested recommendation so long as they comply with NFPA standards. The installing contractor shall coordinate with the department for having the tailpipes modified. All tailpipes will be modified by the owner

P. FANS:

The blower unit shall be a AMCA type B, direct drive spark resistant blower capable of delivering 500 CFM per vehicle. Exhaust fan offered shall be tested in accordance to AMCA standard # 210 in an AMCA approved test facility. The Plymovent TEV-Series Fan shall be a high-pressure blower with standard AMCA type B construction and a backward inclined aluminum fan impeller. The housing material will be galvanized steel with an epoxy powder coated finish. It shall also include a 90-degree rotational discharge and rubber shaft seal and motor mounting support. Refer to schedule for performance data;

1. VEF-1 and VEF-2:
2. HP: 3hp
3. RPM: 3460
4. SP: 3.2” wc
5. CFM: 2,000
6. Power: 208v/3ph/60hz

Housing and impeller:

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The exhaust fan shall be AMCA type B direct drive spark resistant. The housing shall be a one piece construction fabricated from galvanized steel with epoxy powder coated paint inside and out. The design shall allow the user to remove the fan motor and impellor without removing the inlet or outlet duct connections. Impeller shall be fabricated from Aluminum and be designed as a Radial blade backward incline type wheel**.** Fan shall be manufactured as a complete assembly to assure the least possible vibration or movement. Fan wheel shall be both statically and dynamically balanced.

VFD's: shall be arranged with 6 programmable digital inputs, including one for static pressure sensor each. Output Voltage capability of 0-100%, with a scan interval of 5ms.

Sequence of operation:
Upon the vehicles return to the apparatus floor of the station, a 5" dia. exhaust ventilation hose equipped with a magnetic nozzle shall be attached to the vehicle tailpipe at the door opening. Once the system has been secured to the vehicles tailpipe, the exhaust fan shall automatically and instantaneously be energized by the output pressure of exhaust from any motor vehicle to assure total collection of exhaust gases. The vehicle can now back into its designated position and the hose will follow.

Upon emergency dispatch of the vehicle, the output pressure generated by any internal engine shall again automatically energize the exhaust fan. As the vehicle leaves the apparatus floor, the flexible hose shall travel along the track and trolley system with the vehicle as it exits the station. The nozzle shall disconnect automatically from the vehicle at a preset distance from the exiting door. The exhaust fan will continue to run to evacuate the exhaust from the duct system and then shut down automatically.

The fan shall be arranged to modulate based on static pressure in the ductwork. Provide duct static pressure sensor arranged to maintain static pressure setpoint. As vehicles are connected to the hoses and the exhaust system demand increases, fan speed shall increase. As hoses are disconnected and demand decreases, fan speed shall decrease.

H. **Ducting:** U.S. Duct Clampable Ducting Metal ducting utilizing one of several method to join the duct together. Methods include raw ends where duct is welded together, angle rings/flanges where the angle ring is welded to the duct in a fixed method, or angle rings/flanges where the ring is left loose so as to rotate freely on the duct 'behind' a van-stoned end (a 1/2" lip turned at 90 degrees) formed on the end of the duct. In this latter method, the van-stoned ends are pressed together between the joining flanges.

Material: Galvanized

Gauges: Components available in 8-24 gauge depending on diameter and radius of elbows. Elbows are typically 2 gauges heavier than the duct.

Sizes: 6" to 12"
Construction:
Pipe– Lock-seamed, welded seams and/or tubed based upon classification, gauge and material.

Elbows– Stitch welded pressed halves, Segmented 'gore' and then mechanically locked or welded, tubes. Any radius is available. Normally specified in Center Line Radius (CLR)

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Branches– Spot welded or welded reducers with full welded laterals constructed with 45-degree laterals. Cut-offs- Aluminum with Galvanized blades

Application/Gauge/Welding Method Notes- Duct is built in accordance with SMACNA guidelines which are based upon operating pressures, abrasiveness relative to conveyed material and velocities. Angle ring/flanges are welded to the duct accordingly.

Hanging– Generally accepted methods include cable hangers and saddle hangers.

Exhaust Joint Construction -All joint connections which are not continuous welded shall be supplied with a transition coupling from the downstream end only. Coupling shall be fully welded and shall provide a fitting size projection to fit inside a downstream fitting or another duct section. Couplings shall have a two-inch minimum insertion length and shall be 2 gauge numbers (one even gauge number) heavier than the duct to which they are connected. This along with a 600 high temperature silicon seal will constitute the primary mechanical seal

Duct Conveying Velocity -Shall be a minimum of 2000 - 3000 feet / minute transport velocity per UMC code.

Exhaust Rain Cap
Shall be manufactured in accordance with EPA standard for free draft rain cap requirements. Included as an intricate part of this rain cap shall be a back-draft damper to provide protection from rain and other inclement weather.

Exhaust Duct Penetration
In all cases when making a wall penetration it should be clearly indicated in the bid drawing and be accomplished via use of a professional core drilling machine if possible. The core drilling shall be properly sized to reduce the diameter to the smallest possible size.

Q. CONTROLLER TYPE

Shall be manufactured and delivered as an Operating System Three series controller, as manufactured by Plymovent Corporation or as an equal to the specifications to follow.

R. CONTROLLER LOGIC

Shall be designed to sense the output pressure which is normally generated by any internal combustion engine designed to propel any motor vehicle. The operating logic shall be designed to complete this cycle, at any point in time, when a collection device is connected to a motor vehicle's exhaust tail pipe and at which time the vehicle is manually or automatically energized by the operator. This controller shall in turn automatically sense the engine's output pressure and in turn energize the electrical contactors which will provide proper full load amperage to the exhaust system motor. The controller, through the use of a three minute adjustable timer, shall keep the contactors energized for the three minute minimum fixed time.

S. ELECTRICAL PROTECTION

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To protect the apparatus electrical system from any possible damage, the system shall not incorporate any design that requires the apparatus to be utilized as an electrical ground.

T. CERTIFICATION/APPROVALS

Electrical controller offered to the department shall be approved by Underwriters Laboratories (UL) as a complete electrical system for enclosed industrial control panels.

U. ELECTRICAL ENCLOSURE

Shall be NEMA 12 rated and UL listed as Type 12.

V. ENCLOSURE KEYLOCK

Shall be provided and mounted in electrical enclosure to restrict access to internal components of controller by only authorized entry.

W. ELECTRICAL CONTACTORS

Shall be Allen Bradley industrial electrical contactors provided with the appropriate adjustable overload relays to meet the proper full load amperage of motor it is designed to control. Contactor shall conform to the following standards: BS-5424, VDE0660, and be approved by UL Certification as an approved component.

X. CONTROL TRANSFORMER

To be UL listed industrial control circuit transformer with primary and secondary fuse blocks. Transformer shall be provided with multitap primary 208V through 480V, AC, and 24V through 120V secondary.

Y. ELECTRICAL TIMER

Shall be solid state, 3 minute adjustable timer. Operating logic shall complete this cycle; Input voltage is applied to the timer at all times. Upon closure of a normally open isolated start switch, the load energizes and remains energized as long as the switch is closed. When the start switch opens, the timing cycle starts. At the end of the present time delay, the load de-energizes and the timer is ready for a new timing cycle. Timer shall be UL Recognized component under file number E65038.

Z. ENGINE START SWITCH

Start switch shall be engine pressure sensing type capable of recognizing the output pressure of any type of motor vehicle. Electrical contact shall be dry type or not exceed 24V.

AA. PUSH TO STOP BUTTON

Shall be Allen Bradley illuminated amber contact push button. This device shall meet UL Type 4X rating. Indicator light/start button shall be mounted on the enclosure cover and be identified by engraved ledger plate.

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BB. WIRING

Wiring shall be run in wire channel to allow for easier identification of wiring circuit and appearance. All wiring circuitry shall meet UL listed for proper bending radiuses and terminations

CC. TERMINAL BLOCK

Shall be 600 V, UL rated, recognized and shall provide individual connection points for remote controls, power and motor connections.

DD. WIRING IDENTIFICATION

Shall be computer generated and identify all terminals, fuses, contactors, on both supply and termination points.

EE. LABELING

Shall be provided and secured permanently to the exterior of electrical controller, indicating the manufacturer, his address and telephone number. The cover shall also have user instructions and any warnings or cautions required by Underwriter Laboratories.

FF. ELECTRICAL WIRING SCHEMATIC

Wiring schematic shall be provided with each electrical control box supplied. Wiring schematic shall show internal circuitry as well as all primary and secondary connections to the controller. This schematic shall be provided as a "D" print drawing to the department.

GG. ELECTRICAL INTERFERENCE

It is in the department's best interest to reject any design of electrical controller which utilizes or produces electrical frequency transmission or any possibility of electrical backfeed which may interfere with a central services communication or onboard vehicle computer logic or navigational equipment.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install system level and plumb, and in accord with manufacturer's written instructions, original design and referenced standards.
B. Hose reels must be mounted securely from the building steel or suitable structure.
C. Install wall support, leg brackets, and suspended mounting brackets in accordance with manufactures installation guidelines, at the locations required to provide adequate clearance be trucks and rail system and to provide smooth and hose operation.

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D. Coordinate the all components locations in the field with overhead doors, lights, sprinkler piping, and HVAC equipment.
E. Install exhaust pipe adaptors/connection to each vehicle for the magnetic grabber system in accordance with manufactures requirements

3.03 ADJUSTING

A. Adjust system for proper operation. Replace any parts that prevent the system from operating properly.

3.04 CLEANING

A. Remove all debris caused by installation of the system. Clean all exposed surfaces to as fabricated condition and appearance.

3.05 DEMONSTRATION

A. Provide the end user a minimum of one hour of hands-on demonstration and operation of the system.

3.06 PROTECTION

A. Provide protection of the completed installation until completion of the project. Repair any damage at no additional cost to owner

3.07 START UP

3.08 WARRANTY

A. Provide a written warrantee for a period of one year from date of shipment for all components.

END OF SECTION 23 84 16

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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. Alpha Wire Company.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable; General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

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B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI and Type SO with ground wire.

E. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

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. 3M.
2. AFC Cable Systems, Inc.
3. Hubbell Power Systems, Inc.
4. ILSCO.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
6. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

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3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway or Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

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3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

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a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and testing agency's field supervisor.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

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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. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. ILSCO.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

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2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

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3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

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E. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

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E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Manhole Grounds: 10 ohms.

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F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Hangers.
b. Steel slotted support systems.
c. Trapeze hangers.
d. Clamps.
e. Turnbuckles.
f. Sockets.
g. Eye nuts.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

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. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. Thomas & Betts Corporation, A Member of the ABB Group.
   e. Unistrut; an Atkore International company.

2. Material: Galvanized steel.
3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

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E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Hilti, Inc.
      3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      4) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

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PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.

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5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

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1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

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PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
4. Southwire Company.
5. Thomas & Betts Corporation, A Member of the ABB Group.
6. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: Compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

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2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. CANTEX INC.
3. Kraloy.
4. RACO; Hubbell.
5. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC and Type EPC-80 PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

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. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Legrand/Wiremold
d. Panduit

2.5 BOXES, ENCLOSURES, AND CABINETS

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. Cooper Technologies Company.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a brand of Pentair Equipment Protection.
5. Hubbell Incorporated.
6. MonoSystems, Inc.
7. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
8. RACO; Hubbell.
9. Thomas & Betts Corporation, A Member of the ABB Group.
10. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

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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. Armorcast Products Company.
    b. Carson Industries LLC.
    c. NewBasis.
    d. Oldcastle Precast, Inc.
    e. Quazite: Hubbell Power Systems, Inc.
    f. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC under vehicle traffic.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

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5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

   a. Loading dock.
   b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

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E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

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P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

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4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

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4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

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3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Rectangular Openings:

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1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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. HOLDRITE.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

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B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

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D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification 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, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

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D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. LEM Products Inc.
e. Marking Services, Inc.
f. Panduit Corp.

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B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.
d. Seton Identification Products.

C. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.

a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable or raceway diameter, such that the clear shield overlaps the entire printed legend.

3. Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

a. Nominal Size: 3.5-by-5-inch.

4. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
5. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

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2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Panduit Corp.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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. Carlton Industries, LP.
b. Champion America.
c. Ideal Industries, Inc.
d. Marking Services, Inc.
e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.

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b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

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. LEM Products Inc.
b. Marking Services, Inc.
c. Seton Identification Products.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

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. Carlton Industries, LP.
b. Seton Identification Products.

E. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. LEM Products Inc.
d. Marking Services, Inc.
e. Reef Industries, Inc.
f. Seton Identification Products.

2. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

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a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag:

a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches.
c. Overall Thickness: 5 mils.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 28 lb/1000 sq. ft..
f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.
e. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Grafoplast Wire Markers.

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e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products.

C. Write-On Tags:

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. Carlton Industries, LP.
   b. LEM Products Inc.
   c. Seton Identification Products.
2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

4. 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. Carlton Industries, LP.
   b. Champion America.
   c. emedco.
   d. Marking Services, Inc.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

4. 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:

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a. Brady Corporation.
b. Champion America.
c. emedco.
d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inches, minimum 1/16-inch-
b. For signs larger than 20 sq. inches, 1/8 inch thick.
c. Engraved legend with black letters on white face.
d. Punched or drilled for mechanical fasteners.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.

2.8 CABLE TIES

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. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.

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3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

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F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "STANDBY POWER."
2. "POWER."
3. "UPS."

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

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1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:

        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.

    c. Colors for 480/277-V Circuits:

        1) Phase A: Brown.
        2) Phase B: Orange.
        3) Phase C: Yellow.

    d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.

I. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

    1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
    2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
    3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

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K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

   a. Power-transfer switches.
   b. Controls with external control power connections.

N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

O. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

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d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchboards.
e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
f. Emergency system boxes and enclosures.
g. Enclosed switches.
h. Enclosed circuit breakers.
i. Enclosed controllers.
j. Variable-speed controllers.
k. Push-button stations.
l. Power-transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery-inverter units.
p. Power-generating units.
q. Monitoring and control equipment.
r. UPS equipment.

END OF SECTION 260553

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Photoelectric switches.
   2. Indoor occupancy sensors.
   3. Switchbox-mounted occupancy sensors.

B. Related Requirements:

   1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Show installation details for the following:

      a. Occupancy sensors.

   2. Interconnection diagrams showing field-installed wiring.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's warranties.

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1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

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. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. Tyco Electronics Corporation; a TE Connectivity Ltd. company.

B. Description: Solid state, with SPST dry contacts rated for 1000 W incandescent or 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
6. Failure Mode: Luminaire stays ON.

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2.2 INDOOR OCCUPANCY SENSORS

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. Bryant Electric.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. Lutron Electronics Co., Inc.
7. NSi Industries LLC.
8. Philips Lighting Controls.
9. Sensor Switch, Inc.
10. Square D.
11. Watt Stopper.

B. General Requirements for Sensors:

1. Ceiling-mounted, solid-state indoor occupancy sensors.
2. Dual technology.
3. Separate power pack.
4. Hardwired connection to switch.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:

    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Sensor is powered from the power pack.
8. Power: Line voltage.
9. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

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C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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. Bryant Electric.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. Lutron Electronics Co., Inc.
7. NSi Industries LLC.
8. Philips Lighting Controls.
9. Sensor Switch, Inc.
10. Square D.
11. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..

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2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP.
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
9. Color: White.
10. Faceplate: Color matched to switch.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

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C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

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3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.7 DEMONSTRATION

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

END OF SECTION 260923

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SECTION 260943.23 - RELAY-BASED LIGHTING CONTROLS

PART 1 –GENERAL

1.1 SUMMARY

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system. All Labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section.

1.2 DESCRIPTION OF WORK

A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacturers catalog numbers, when listed in this section are for reference only. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

B. The system shall include but not be limited by the following list: Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relays panels controlled via a complete list of communication based accessories including digital switches, digital photocells, digital SmartBreaker panelboards, Digital Time Clock (DTC) and interface cards to dimming systems, building automation systems, thermostats, and other devices. The type of lighting control equipment and wiring specified in this section is covered by the description: Microprocessor Controlled Digital Relay Lighting Control system with RS 485 Bus communications. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring. They are not the work of this section.

1.3 SUBMITTALS

A. Section 260500 – Shop Drawing Requirements.

B. Shop Drawings: Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, DTC, photocells and other interfaces. Shop drawings shall indicate exact location of each device or a RFI to confirm location. Plans are diagrammatical. EC to verify all lighting control material requirements from approved shop drawings. “Cut Sheet” submittal not acceptable.

C. Product Data: Submit for approval 6 copies of manufacturer's data on the specific lighting control system and components. Submittal shall be in both electronic and hard copy formats. To prevent departures from approved system operation, electronic file submitted shall be able to be directly downloaded to the specified system at manufacturer facility.

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Submit a complete bill of materials with part numbers, description and voltage specifications.

D. One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component if it differs from that illustrated in the riser diagram in these specifications. Submittals that show typical riser diagrams are not acceptable.

1.4 QUALITY ASSURANCE

A. Products shall be manufactured by Lighting Control & Design, Los Angeles, CA, 800.345.4448 or approved equal. Such firms shall be regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Any product other than those listed in this specification must be pre-approved a minimum of two weeks before bid time. No exceptions.

B. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer specification.

C. A licensed electrician shall functionally test each system component after installation, verify proper operation and confirm that all relay panel and switch wiring conform to the wiring documentation. The Electrical Contractor (EC) is required to phone LC&D a minimum of 7 days before turnover for system checkout. At time of LC&D contact, all components to include phone line to modem must be installed, powered and operational.

D. Comply with NEC and all local and state codes as applicable to electrical wiring work.

E. Lighting relay panels shall be UL 916 Listed. LRPs controlling emergency circuits shall be ETL listed to UL 924. Emergency source circuits controlled in normal operation by a relay panel shall fully comply with NEC 700-9(b). Electrical contractor is responsible for verifying compliance.

F. The lighting control system shall be listed, approved and comply as required with all national, state and local energy codes to include but not limited to California Title 24 and ASHRAE 90.1-2004.

1.5 MAINTENANCE MATERIALS

A. Division 1 - Execution Requirements: Spare parts and maintenance products.

B. Provide 10% spare relays per LRP, up to the maximum capacity of the LRP.

C. Provide CD version of manufacturers operating software to include graphical interface software.

D. Provide 2 extra sets of as-built and operating manuals.

1.6 SUBSTITUTIONS

A. Substitutions are permitted as voluntary alternates. Base bid must reflect the specified equipment.

B. A product must go through the following process before being approved as a substitution:
   1. A list of substitutions shall be provided to the owner as an attachment to the bid form. Submit along with bill of material, CD of proposed operating system, and

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a one line diagram of the system configuration proposed indicating the type, size and number of conductors between each component if it differs from that illustrated in the riser diagram in these specifications.

2. The list will be reviewed by the owner and the engineer to determine whether the equipment meet the project needs. A $500 retainer will be submitted with the list of voluntary alternates to cover this meeting. If the owner and engineer agree that this meeting is not required, then the $500 will be returned to the contractor.
3. The retainer is for evaluation of the alternate. The retainer is to be used to cover the time spent in this evaluation. The fee will be collected based on time spent in evaluation, not on whether the alternate is accepted. All unused portions will be returned to the contractor with an invoice marked "paid" by the engineer, architect, and/or owner.

1.7 SYSTEM DESCRIPTION

A. The lighting control system is a networked system that communicates via RS485. The system must be able to communicate with fully digital centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells, various interfaces and shall include all operational software. The intent of the specification is to integrate all lighting control into one system, except for areas controlled by a single motion sensor such as rooms with a single luminaire and emergency fixtures designed to operate 24/7. Distributed lighting control shall be provided using a networked micro relay panel. A centralized relay panel shall control corridors and site lighting. Lighting control system shall include all hardware and software. Software to be resident within the lighting control system in Facility Manager's Office. System shall provide local access to all programming functions at the master LRP and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have server built into the master LRP that "serves" HTML pages to any authorize workstation. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital, non-server capable systems not acceptable.

B. System software shall provide real time status of each relay, each zone and each group.

C. Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on line PC or server for normal operation are not acceptable

D. All devices shall be pre-addressed at the factory. Field addressing is not acceptable.

E. All programs, schedules, time of day, etc, shall be held in non-volatile memory for a minimum of 10 years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.

F. System shall be capable of flashing lights Off/On any relay or any zone prior to the lights being turned Off. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and not exceed 2-hours.

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G. The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, specification grade line voltage type wall switches, photocell, web based software or other devices connected to programmable inputs in a lighting control panel.

H. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the master LRP and remotely via dial up modem and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.

I. System may consist of centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells and various digital interfaces. Verify exact components specified. Micro relay panels, smart breaker panels, centralized relay panels and digital switches shall communicate as one network via RS485. Micro relay panels, mounted in each local area, per plans shall control all lighting fixtures in that space, provide power to occupancy sensors and take input from daylight sensor and occupancy sensors. Micro relay panels shall be capable of taking inputs from standard, line voltage type switches and outputting up to 8 independent 0v to 10v dimming signals. All micro relay panels and all devices connected to micro relay panels (switches, photocells and occupancy sensors, etc) shall be wired per lighting control manufacturers instructions.

PART 2 - PRODUCTS

2.1 MATERIAL AND COMPONENTS

A. Relay Panels:

1. NEMA rated enclosure with screw cover or hinged door. Other NEMA types optional.
2. 16 AWG steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120v and 277v.
3. LRP input power shall be capable of accepting 120v or 277v without rewiring.
4. Control electronics in the low voltage section shall be capable of driving 2 to 48, 30a, 18,000 SCCR rated latching relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control relays that default to Open, Normally Open Latching (NOL) or relays that default to Closed, Normally Closed Latching (NCL).
5. Lighting control system shall be digital and consist of a Master LRP, Slave LRPs, Micro LRPs with up to 8 individual relays, digital switches, digital interface cards and if required, SmartBreaker panelboards. All system components shall connect and be controlled via a single Category 5, 4 twisted pair cable with RJ45 connectors, providing real time two-way communication with each system component. Analog systems are not acceptable.
6. The lighting control system is a networked system that communicates via RS485 and includes centralized relay panels, micro relay panels, digital switches, photocells, various interfaces and operational software. The intent of the specification is to integrate all

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lighting controls into one system. Lighting control system shall include all hardware and software. Software to be resident within the lighting control system. System shall provide local access to all programming functions at the DTC and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have server built into the master LRP that "serves" HTML pages to any authorized workstation. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital system not acceptable.

B. Micro Relay Panels

1. Micro relay panels shall have up to 8-30a, 18,000 SCCR rated lighting relays and shall control all lighting in the designated area indicated on the plans and be networked to centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells, various interfaces. Each micro relay panel shall provide minimum 300ma at 12/24vdc for powering occupancy sensors. Micro relay panels that require a separate occupancy sensor power pack are not acceptable.
2. Micro relay panel shall provide a minimum 4-programmable photocell inputs, a minimum 4-programmable occupancy sensor inputs and matrixed contact closure inputs. This requirement is to insure integration of entire lighting system into one networked, lighting control system.
3. Micro relay panels shall be capable of outputting minimum 4 and up to 8 independent 0v to 10v dimming signals, one independent dimming signal at each of 8 relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. All photocell setting must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

C. Standard Output relays

1. UL Listed 30 Amp, Latching, 18,000 SCCR, 277VAC Ballast and HID and 20 Amp Tungsten at 120 Vac.
2. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8AWG wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable.
3. Relays to be rated for 250,000 operations minimum at a full 30a lighting load, default to closed at normal power loss, Normally Closed Latching (NCL). All incandescent circuits shall be energized by use of a Normally Closed SoftStart™ (NCSS) relay rated at 100,000 operations at full 20a load. No exceptions.
4. Optional relay types available shall include: Normally Open Latching (NOL) relay rated for 250,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

D. Low Voltage Switches

1. All switches shall be digital and communicate via RS 485. Contact closure style switches, except as specified for connection to the micro relay panel matrixed contact closure inputs, shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double EPROM memory. Any digital switch button function shall be

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able to be changed locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.

2. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for On only, Off only, On/Off (toggle), Raise (Dim up) and Lower (Dim down). Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.
3. Keyed switches shall be programmable and connect to the lighting controls system bus.
4. Digital switches for high abuse areas (common areas, gymnasiums, etc.) shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to three buttons in a single gang. Multi gang versions shall also be available. Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations. High abuse switches shall connect to the lighting control system digital bus. Each high abuse switch touch button shall be able to be control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for On, Off, Toggle or Maintain operation. All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cmspark) without any interruption or failure in operation.

E. DTC - Digital Electronic Time Clock

1. A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept interface inputs.
2. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.
3. The DTC shall be capable of controlling up to 126 digital devices on a single bus and capable of interfacing digitally with other individual busses using manufacturer supplied interface cards.
4. The DTC shall accept control locally using built in button prompts and use of a 8 line 21-letter display or from a computer or modem via an on-board RS 232 port. All commands shall be in plain English. Help pages shall display on the DTC screen.
5. The DTC shall be run from non-volatile memory so that all system programming and real time clock functions are maintained for a minimum of 15 years with loss of power.
6. Pre-installed Unity™ lighting control software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone. System shall be capable of running optional Unity GX lighting control software, which shall provide for directly importing vector based graphics. No exceptions.
7. Pre-Installed modem that allows for remote programming from any location using a PC. Modem to include all necessary software for local or remote control.
8. DTC shall provide system wide timed overrides. Any relay, group or zone that is overridden On, before or after hours, shall automatically be swept Off by the DTC a maximum of 2 hours later.

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F. PHOTOCELL: Photocells to be mounted in location indicated on the plans. Photocells used for exterior lights shall provide multiple trips point from 1 roof mounted unit. All trips points shall be able to be changed remotely via Internet or dial up modem. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photocells to be certified to comply with the current energy code covering this project at time of submittal of plans for building permit.

G. Interfaces: For future expansion capability, system to have available all of the following interfaces. Verify and install only those interfaces indicated on the plans.

1. A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card.
2. Interface card providing digital communication from one system bus to another system bus, allowing up to 12,000 devices to communicate.
3. An interface card that allows the DTC to control up to 32 digital XCI brand thermostats. Programming of thermostats to be able to done locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.
4. A voice prompted telephone override interface module. Interface module shall accept up to 3 phone lines and allow up to 3 simultaneous phone calls. Voice prompted menu and up to 999 unique pass codes shall be standard with each interface module.
5. Software pre-installed to run Unity GX Graphical Interface Software. Unity GX software shall provide via local or remote PC a visual representation of a specific area or the total area of the project. GX full graphic pages shall be designed to the owner's specifications. Owner to provide to manufacturer all necessary files and criteria. Provide ____ GX pages.
6. Direct digital interface to SmartBreaker panelboards. Relay panel and SmartBreaker panelboard circuits shall appear on the system software as similar, yet distinct, items and maintain all functions and features of the system software.
7. Direct digital interface to building automation systems using DDC protocols such as BACnet, Metasys (N2) and ModBus that accept on/off commands, time schedules and report status of all relays in all panels in real time. Interface cards shall "self populate" each individual relay and each group to the BAS. All BAS system programming required shall be the responsibility of the BAS system provider.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Mount relay control cabinets adjacent to respective lighting panelboard. Cabinet shall be surface or flush mount, per plans. Wiring between relay control cabinet and panelboards to be per local codes and acceptable industry standards. Under no circumstances will any extra be authorized for payment to the EC or GC due to the EC's lack of knowledge or understanding of any and all prevailing codes or specified manufacturer's installation requirements. Neatly lace and rack wiring in cabinets. During construction process, protect all interior components of each relay panel and each digital switch from dust and debris. Any damage done to electronic components due to non-protection shall be the sole responsibility of the installing contractor.

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B. Switches: Provide outlet boxes, single or multi-gang, as shown on the plans for the low voltage digital switches. Mount switches as per plans. Supply faceplates per plans and specifications. EC is specifically responsible to supply and install the required low voltage cable, Category 5, 4 twisted pair, with RJ45 connectors and snagless boots (commonly referred to as Cat 5 patch cable) between all switches and panels. Field-test all Cat 5 patch cable with a recognized cable tester. All low voltage wire to be run in conduit, per local codes.

C. Wiring

1. Do not mix low voltage and high voltage conductors in the same conduit. No exceptions.
2. Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.
3. Place manufacturer supplied “terminators” at each end of the system bus per manufacturers instructions.
4. Neatly lace and rack wiring in cabinets.
5. Plug in Category 5 patch cable that has been field-tested with a recognized cable tester, at the indicated RJ45 connector provided at each lighting control device, per manufacturers instructions.
6. Use Category 5 patch cable for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Contact LC&D or refer to the GR2400 manual for further information. Use shielded cable for dry contact inputs to lighting control system.
7. Do not exceed 4000ft-wire length for the system bus.
8. All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.
9. The specified lighting control system shall be installed by the electrical contractor who shall make all necessary wiring connections to external devices and equipment, to include photocell. EC to wire per manufacturer instructions.

3.2 INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's plans and approved shop drawings for location of line and low-voltage areas. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

B. For approved line voltage type micro relay panel switches connected to matrixed inputs of the micro relay panel, furnish #18 AWG solid conductors. For all other digital switches provide wiring required by system manufacturer.

C. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.

D. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:

1. Confirmation of entire system operation and communication to each device.

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2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors
3. Confirmation of system Programming, photocell settings, override settings, etc.
4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

E. Panels shall be located so that they are readily accessible and not exposed to physical damage.

F. Panel locations shall be furnished with sufficient working space around panels to comply with the National Electric Electrical Code.

G. Panels shall be securely fastened to the mounting surface by at least 4 points.

H. Unused openings in the cabinet shall be effectively closed.

I. Cabinets shall be grounded as specified in the National Electrical Code.

J. Lugs shall be suitable and listed for installation with the conductor being connected.

K. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

L. Maintain the required bending radius of conductors inside cabinets.

M. Clean cabinets of foreign material such as cement, plaster and paint.

N. Distribute and arrange conductors neatly in the wiring gutters.

O. Follow the manufacturer's torque values to tighten lugs.

P. Before energizing the panelboard, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
2. Remove shipping blocks from component devices and the panel interior.
3. Remove debris from panelboard interior.

Q. Follow manufacturers’ instructions for installation and all low voltage wiring.

R. Service and Operation Manuals:

1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.
2. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.

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S. Comply with energy code lighting control system "Acceptance Requirements". Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly. This is the installing contractors responsibility. Verify requirements with building authority.

3.3 DOCUMENTATION

A. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the drawings. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

B. Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to owner, copies placed inside the door of each LRP.

3.4 SERVICE AND SUPPORT

A. Start Up: EC shall contact LC&D at least 7 days before turnover of project. LC&D will remotely dial into the lighting control system, run diagnostics and confirm system programming. EC shall be available at the time of dial in to perform any corrections required by LC&D. EC is responsible for coordinating with GC and the owner the installation of a dedicated telephone line or a shared phone line with A/B switch. Phone jack to be mounted within 12" of Master LRP. Label jack with phone number. EC to connect phone line from jack to Master LRP.

B. Telephone factory support shall be available at no additional cost to the EC or Owner both during and after the warranty period. Factory to pre-program the lighting control system per plans and approved submittal, to the extent data is available. The specified manufacturer, at no added cost, shall provide additional remote programming via modem as required by the EC or Owner for the operation life of the system. Upon request manufacturer to provide remote dial up software at no added cost to system owner. No exceptions.

C. Provide a factory technician for on-site training of the owners' representatives and maintenance personnel. Coordinate timing with General Contractor. Provide 2 days of factory on-site training.

3.5 COMMISSIONING

A. Provide Commissioning in accordance with 2015 International Energy Conservation Code.
B. Provide document from registered design professional that lighting control systems have been tested to ensure that control hardware and software functional tests are calibrated, adjusted, programmed and in proper working conditioning in accordance with construction documents and manufacturer's instructions.

CLEANING

C. Division 1 - Execution Requirements: Final cleaning.

D. Clean photocell lens as recommended by manufacturer.

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E. Clean all switch faceplates.

END OF SECTION 26094

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SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

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3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

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1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

F. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

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2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Fused Switch.

E. Branch Overcurrent Protective Devices: Fused switches.

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2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

   a. Inverse time-current element for low-level overloads.
   b. Instantaneous magnetic trip element for short circuits.
   c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
4. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
5. Subfeed Circuit Breakers: Vertically mounted.
6. MCCB Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.

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b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
i. Multipole units enclosed in a single housing with a single handle.
j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
k. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories:

a. Standard ampere ratings and number of poles.
b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
c. Auxiliary Contacts: Two normally open and normally closed contact(s) that operate with switch handle operation.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

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2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

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I. Mount surface-mounted panelboards to steel slotted supports 1-1/4 inch in depth. Orient steel slotted supports vertically.

J. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

L. Install filler plates in unused spaces.

M. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

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1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Instruments and Equipment:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

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3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

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SECTION 262713 - ELECTRICITY METERING

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 electricity metering work to accommodate utility company revenue meters.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of meter.
2. For metering infrastructure components.

B. Shop Drawings: For electricity-metering equipment.

1. Include elevation views of front panels of control and indicating devices and control stations.
2. Include diagrams for power, signal, and control wiring.
3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

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1. Owner shall be notified and issued written permission no fewer than seven days in advance of proposed interruption of electrical service.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.
3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.7 COORDINATION

A. Electrical Service Connections:

1. Coordinate with utility companies and utility-furnished components.

a. Comply with requirements of utility providing electrical power services.
b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 916.

2.2 UTILITY METERING INFRASTRUCTURE

A. Install metering accessories furnished by the utility company, complying with its requirements.

B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.

C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

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D. Meter Sockets:

1. Comply with requirements of electrical-power utility company.
2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install arc-flash labels as required by NFPA 70.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive labels, with text as required by NFPA 70.
2. Equipment Identification Labels: Self-adhesive labels with clear protective overlay.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Equipment and Software Setup:

a. Set meter date and time clock.
b. Test, calibrate, and connect pulse metering system.
c. Set and verify billing demand interval for demand meters.
d. Report settings and calibration results.
e. Set up reporting and billing software, insert billing location names and initial constant values and variable needed for billing computations.

2. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
3. Turn off circuits supplied by metered feeder and secure them in off condition.

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4. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
5. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
6. Generate test report and billing for each tenant or activity from the meter reading tests.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262713

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB charger devices.
3. Twist-locking receptacles.
4. Weather-resistant receptacles.
5. Snap switches.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Floor service outlets and poke-through assemblies.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

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1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 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. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.

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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. Eaton (Arrow Hart).
   b. Hubbell Incorporated; Wiring Device-Kellems.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, Type A.
4. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration as indicated on drawings, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
   b. Hubbell Incorporated; Wiring Device-Kellems.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

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2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

C. GFCI, Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Pass & Seymour/Legrand (Pass & Seymour).

D. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

E. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: With neon-lighted handle, illuminated when switch is "off."

F. All branch circuits rated at 15 amperes shall only have receptacles rated at 15 amperes connected to it.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces including garage, work and storage areas: 0.035” satin-finished stainless steel.
3. Material for Unfinished Spaces such as mechanical room, electrical room, janitor closets: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum box with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

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2.10 POKE-THROUGH ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand (Pass & Seymour).
3. Square D; by Schneider Electric.
4. Thomas & Betts Corporation, A Member of the ABB Group.
5. Wiremold / Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Pedestal type with services indicated.
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.11 FINISHES

A. Device Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated by architect or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

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2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

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1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

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SECTION 262813 - FUSES

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. Cartridge fuses rated 600 V ac and less for use in the following:

   a. Control circuits.
   b. Panelboards
   c. Enclosed controllers.
   d. Enclosed switches.

B. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Coordination charts and tables and related data.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

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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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg For more than 100 deg F apply manufacturer's ambient temperature adjustment factors to fuse ratings.

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. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.
4. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

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E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK1, time delay.
4. Power Electronics Circuits: Class J, high speed.
5. Other Branch Circuits: Class J, fast acting.
6. Control Transformer Circuits: Class CC, time delay, control transformer duty.
7. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

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3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Owner.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

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1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

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1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.

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4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

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3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

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3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

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SECTION 263213.14 - DIESEL ENGINE GENERATORS

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 packaged engine generators used to supply non-emergency power, with the following features:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Vibration isolation devices.
7. Finishes.

B. Related Requirements:
1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.

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6. Include airflow requirements for cooling and combustion air in cubic feet per minute at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F. Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.

C. Field quality-control reports.

D. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

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a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.7 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. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal:
1. Cummins Power Generation – Basis of Design.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

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2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.

C. UL Compliance: Comply with UL 2200.

D. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.

E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Industrial.

D. Power Rating: 300 kW.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 208-V ac.

H. Phase: Three-phase, four wire, wye.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

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K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

L. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

M. Engine Generator Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

b. Motor starting capability shall be a minimum of 2577 KVA. The generator set shall meet requirements per NEMA MG1-32.18.2.5; The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified motor starting KVA (3866) overload at near zero power factor applied to the generator set and recover to 100% voltage level. The maximum voltage dip an application of low power factor load of 4 times rated KVA, based on constant alternator speed, shall not exceed 30%.

2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

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8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

    a. Provide permanent magnet excitation for power source to voltage regulator.

10. Start Time: 10 seconds.

2.4 DIESEL ENGINE

A. Fuel: ASTM D 975, diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

E. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

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1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.

F. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

G. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 60 seconds.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

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f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

F. Control and Monitoring Panel:

1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.

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2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, connected to a phase selector switch.
    f. AC ammeter, connected to a phase selector switch.
    g. AC frequency meter.
    h. Generator-voltage adjusting rheostat.

3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low-water temperature alarm.
    g. High engine temperature pre-alarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Low fuel main tank.

        1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required in "Fuel Tank Capacity" Subparagraph in "Diesel Fuel-Oil System" Article.

    m. Coolant low-level alarm.
    n. Coolant low-level shutdown device.
    o. Coolant high-temperature prealarm.
    p. Coolant high-temperature alarm.
    q. Coolant low-temperature alarm.
    r. Coolant high-temperature shutdown device.
    s. Battery high-voltage alarm.
    t. Low cranking voltage alarm.
    u. Battery-charger malfunction alarm.
    v. Battery low-voltage alarm.
    w. Lamp test.
    x. Contacts for local and remote common alarm.
    y. Low-starting air pressure alarm.
    z. Low-starting hydraulic pressure alarm.
    aa. Remote manual stop shutdown device.
    bb. Air shutdown damper alarm when used.
    cc. Air shutdown damper shutdown device when used.
    dd. Generator overcurrent-protective-device not-closed alarm.

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ee. Hours of operation.
ff. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

G. Engine Generator Metering: Comply with Section 262713 "Electricity Metering."

H. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.

2. Provide connections for datalink transmission of indications to BMS remote data terminals via ModBus.

I. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature pre-alarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Generator overcurrent-protective-device not-closed alarm.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

K. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

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2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs. Refer to one line riser diagram for additional information.

B. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

C. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator output rating.
3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
4. Mounting: Adjacent to, or integrated with, control and monitoring panel.

D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six-lead alternator.

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E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12.7 percent, maximum.

L. Alternator temperature rise shall be 80 C for standby operation, at a voltage of 208 VAC.

2.9 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 1 inch.

B. Comply with requirements in Section 232116 "Hydronic Piping Specialties" for vibration isolation and flexible connector materials for steel piping.

C. Comply with requirements in Section 233113 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

D. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

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2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
10. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 404.

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B. Comply with packaged engine generator manufacturers' written installation and alignment instructions.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Install packaged engine generator with elastomeric isolator pads or restrained spring isolators having a minimum deflection of 1 inch on 4-inch-high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
2. Install flexible connectors and steel piping materials according to requirements in Section 232116 "Hydronic Piping Specialties."
3. Insulate muffler/silencer and exhaust system components according to requirements in Section 230719 "HVAC Piping Insulation."

F. Drain Piping: Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.

1. Piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
2. Drain piping valves, connectors, and installation requirements are specified in Section 232116 "Hydronic Piping Specialties."

G. Fuel Piping:

1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
2. Copper and galvanized steel shall not be used in the fuel-oil piping system.

H. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

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3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.4 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

a. Visual and Mechanical Inspection:

1) Compare equipment nameplate data with Drawings and the Specifications.
2) Inspect physical and mechanical condition.
3) Inspect anchorage, alignment, and grounding.
4) Verify that the unit is clean.

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b. Electrical and Mechanical Tests:

1) Perform insulation-resistance tests according to IEEE 43.

a) Machines Larger Than 200 hp Test duration shall be 10 minutes. Calculate polarization index.
b) Machines 200 hp or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.
3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Perform vibration test for each main bearing cap.
6) Verify correct functioning of the governor and regulator.

2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
5. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

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E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

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

END OF SECTION 263213.14

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes automatic transfer switches rated 600 V and less, including the following:

1. Remote annunciator system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Include material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, power sources, and load.
4. Riser Diagram: Show interconnection wiring between transfer switches and annunciators.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer-authorized service representative.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

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1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

   a. Features and operating sequences, both automatic and manual.
   b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless requirements of these Specifications are stricter.

E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
   1. Short-time withstand capability for three cycles.

G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically

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and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

J. Neutral Terminal: Solid and fully rated unless otherwise indicated.

K. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

L. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed shrinkable sleeve markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Accessible via front access.

M. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASCO

2. Cummins Power Generation.
3. Kohler.
4. Generac Power Systems, Inc.
.

B. Comply with Level 1 equipment according to NFPA 110.

C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
4. Conductor Connectors: Suitable for use with conductor material and sizes.

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5. Material: Hard-drawn copper, 98 percent conductivity.
6. Main and Neutral Lugs: Mechanical type.
7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
8. Ground bar.
9. Connectors shall be marked for conductor size and type according to UL 1008.

D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.

1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

E. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

G. Digital Communication Interface: Matched to capability of remote annunciator.

H. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.
2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

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9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is unavailable.

2.3 TRANSFER SWITCH ACESSORIES

A. Remote Annunciator System:

1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches.
3. Annunciation panel display shall include the following indicators:

    a. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
    b. Switch position.
    c. Switch in test mode.
    d. Failure of communication link.

4. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

    a. Indicating Lights: Grouped for each transfer switch monitored.
    b. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
    c. Mounting: Flush, modular, steel cabinet unless otherwise indicated.
    d. Lamp Test: Push-to-test or lamp-test switch on front panel.

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2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.

1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:

   a. Overvoltage.
   b. Undervoltage.
   c. Loss of supply voltage.
   d. Reduction of supply voltage.
   e. Alternative supply voltage or frequency is at minimum acceptable values.
   f. Temperature rise.
   g. Dielectric voltage-withstand; before and after short-circuit test.
   h. Overload.
   i. Contact opening.
   j. Endurance.
   k. Short circuit.
   l. Short-time current capability.
   m. Receptacle withstand capability.
   n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

D. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

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B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Connect twisted pair cable according to Section 271513 "Communications Copper Horizontal Cabling."

F. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.

G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. After installing equipment, test for compliance with requirements according to NETA ATS.
2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with Drawings and Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify that the unit is clean.
e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.
h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

i. Perform manual transfer operation.
j. Verify positive mechanical interlocking between normal and alternate sources.

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k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

3. Electrical Tests:

a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.

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d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Transfer switches will be considered defective if they do not pass tests and inspections.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.

C. Coordinate this training with that for generator equipment.

END OF SECTION 263600

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SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

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1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCESUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Electrification Products Industrial Solutions.
2. Advanced Protection Technologies Inc. (APT).
3. ALLTEC.
4. Eaton.
5. Leviton Manufacturing Co., Inc.
6. Liebert; a brand of Vertiv.
7. Mersen USA.
8. Schneider Electric USA, Inc.
9. Siemens Industry, Inc., Energy Management Division.

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B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:
   a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   b. Indicator light display for protection status.
   c. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
   d. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. SCCR: Equal or exceed 100 kA.

G. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Electrification Products Industrial Solutions.
2. Advanced Protection Technologies Inc. (APT).
3. Eaton.
4. Leviton Manufacturing Co., Inc.
5. Liebert; a brand of Vertiv.
6. Mersen USA.
7. Schneider Electric USA, Inc.
8. Siemens Industry, Inc., Energy Management Division.

B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

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3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Comply with UL 1283.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Neutral to Ground: 700 V for 208Y/120 V.
4. Line to Line: 1200 V for 208Y/120 V

F. SCCR: Equal or exceed 100 kA.

G. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

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B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install on all panelboard on dedicated emergency power systems.

D. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

E. Use crimped connectors and splices only. Wire nuts are unacceptable.

F. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

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

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

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END OF SECTION 264313

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SECTION 265119 - LED INTERIOR LIGHTING

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. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.

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3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 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.

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1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

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2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Rated lamp life of 35,000 hours.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: As indicated on Plans.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings:

1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

2.3 DOWNLIGHT

A. See Plans for manufacturers.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.4 LINEAR INDUSTRIAL

A. See Plans for manufacturers.

B. Minimum 5,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Housing and heat sink rated to the following:
1. NEMA 4X.
2. IP 54.

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3. IP 66.
4. Marine and wet locations.
5. CSA C22.2 No 137.

2.5 RECESSED LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.6 STRIP LIGHT

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, LINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.8 SURFACE MOUNT, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.9 SUSPENDED, LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

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2.10 SUSPENDED, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.11 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. prismatic acrylic
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.12 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

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2.13 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 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 luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.

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4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

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3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

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

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

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SECTION 265219 - EXIT LIGHTING

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. Exit signs.
2. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire" Paragraph.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of exit sign.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
4. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
   a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

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2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

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1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 GENERAL REQUIREMENTS FOR EXIT SIGNS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label exit signs to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Bulb Shape: Complying with ANSI C79.1.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

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B. Internally Lighted Signs:

1. See Plans for manufacturers.
2. Operating at nominal voltage of 120 V ac.
3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. Powder coat finish.

E. Conduit: Electrical metallic tubing or Flexible metallic conduit, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. 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.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where exit signs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire weight.
2. Provide support for luminaire without causing deflection of ceiling or wall.
3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

D. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

E. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.

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2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to generator power and retransfer to normal. Testing shall be coordinated with testing requirements specified in Section 263213 "Engine Generators" and Section 263600 “Transfer Switches”.

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

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace exit signs that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 265219

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SECTION 265619 - EXTERIOR LIGHTING

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. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.

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4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturer's Certified Data: Photometric data certified by manufacturer?s laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

C. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of the following:

1. Luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

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1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

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1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Lamp base complying with ANSI C81.61 or IEC 60061-1.

E. Bulb shape complying with ANSI C79.1.

F. CRI of minimum 70. CCT of 4000 K.

G. L70 lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

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I. Internal driver.

J. Nominal Operating Voltage: As indicated on plans.

K. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:

1. See Plans for manufacturers.
2. Luminaire Shape: Square.
3. Mounting: As indicated on plans.
4. Luminaire-Mounting Height: As indicated on architectural plans.
5. Distribution: As indicated on plans.
6. Diffusers and Globes: Prismatic acrylic.
7. Housings:

   a. Extruded-aluminum housing and heat sink.
   b. Powder-coat finish.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

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1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: 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.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

a. Color: As indicated on plans.

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2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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 luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

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1. Attached to structural members in walls.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.

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e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

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SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

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. 62.5/125-micrometer, multimode, optical fiber cable (OM1).
2. 9/125 micrometer single-mode, inside plant optical fiber cable (OS1).
3. Optical fiber cable connecting hardware, patch panels, and cross-connects.
4. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

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1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.
    c. Telecommunications system access points.
    d. Telecommunications grounding system.
    e. Cross-connects.
    f. Patch panels.
    g. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Optical fiber cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

1.8 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. Patch-Panel Units: One of each type.
2. Plugs: Two of each type.
3. Jacks: Two of each type.

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1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Fire Department's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

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B. 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: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 62.5/125-MICROMETER, MULTIMODE, OPTICAL FIBER CABLE (OM1)

A. Description: Multimode, 62.5/125-micrometer, 24 fiber, nonconductive tight buffer, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Networking Division/NORDX.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable; Prysmian Group North America.
5. Mohawk; a division of Belden Networking, Inc.

C. Standards:

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAA for detailed specifications.

D. Conductive cable shall be aluminum armored type.

E. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.

F. Minimum Overfilled Modal Bandwidth-Length Product: 200 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

G. Jacket:

1. Jacket Color: Orange.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

H. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

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1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
2. Riser Rated, Nonconductive: Type OFNP, complying with UL 1666.

2.3 9/125 MICROMETER SINGLE-MODE, INDOOR-OUTDOOR OPTICAL FIBER CABLE (OS1)

A. Description: Single mode, 9/125-micrometer, 24 fibers, stranded loose tube, armored optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Belden CDT Networking Division/NORDX.
3. Corning Cable Systems.
4. General Cable; Prysmian Group North America.
5. Mohawk; a division of Belden Networking, Inc.

C. Standards:

1. Comply with TIA-492CAAA for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-104-696 for mechanical properties.

D. Armored cable shall be aluminum armored type.

E. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.

F. Jacket:

1. Jacket Color: Yellow.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
2. Riser Rated, Nonconductive: Type OFNP, complying with UL 1666.
3. Plenum Rated, Armored (Conductive): Type OFCP, complying with NFPA 262.
4. Riser Rated, Armored (Conductive): Type OFCP; complying with UL 1666 and ICEA S-103-701].

2.4 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Belden CDT Networking Division/NORDX.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.
3. Corning Cable Systems.
4. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
5. Optical Cable Corporation.

B. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

E. Connector Type: Type LC complying with TIA-604-10-B connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.75 dB.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.75 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to a patch panel or faceplate.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

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2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

C. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:

1. Comply with TIA-568-C.1 and TIA-568-C.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."

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3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, provide a 10-foot- (3-m-) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.5 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding

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bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 4.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 4 level of administration[including optional identification requirements of this standard].

C. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

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G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
b. Link End-to-End Attenuation Tests:

1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271323

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SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

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. Category 6 twisted pair cable.
2. Cable management system.
3. Cabling identification products.
4. Grounding provisions for twisted pair cable.
5. Source quality control requirements for twisted pair cable.

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

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M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.
    c. Telecommunications system access points.
    d. Telecommunications grounding system.
    e. Telecommunications conductor drop locations.
    f. Typical telecommunications details.

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g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

D. Samples: For telecommunications jacks and plugs, in specified finish, one for each type and configuration and faceplates for color selection and evaluation of technical features.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 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. Connecting Blocks: One of each type.
2. Faceplates: One of each type.
3. Jacks: Five of each type.
4. Multiuser Telecommunications Outlet Assemblies: Five of each type.
5. Patch-Panel Units: One of each type.
6. Plugs: Five of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings by an RCDD.

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2. Installation Supervision: Installation shall be under the direct supervision of Technician Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CMP complying with UL 1685 .

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2. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.

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

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden CDT Networking Division/NORDX.
3. CommScope, Inc.
4. General Cable; Prysmian Group North America.
5. Mohawk; a division of Belden Networking, Inc.

C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP)

F. Cable Rating: Plenum.

G. Jacket: Yellow thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Belden CDT Networking Division/NORDX.
4. CommScope, Inc.

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5. General Cable; Prysmian Group North America.
6. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
7. Panduit Corp.

C. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

E. Connecting Blocks:
1. 110-style IDC for Category 6.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated plus spares and blank positions adequate to suit specified expansion criteria.

H. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.

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2. Standard: Comply with TIA-568-C.2.

J. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.

K. Faceplate:

1. Two or Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 CABLE MANAGEMENT SYSTEM

A. Description: Computer-based cable management system, with integrated database[and graphic] capabilities.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. iTRACS Corporation.
2. Telsoft Solutions.

C. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

D. Information shall be presented in database view[, schematic plans, or technical drawings].

E. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.
2. Direct download circuit labeling into labeling printer.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

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2.7 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.8 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA-568-C.1.

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

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters[and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Drawings indicate general arrangement of boxes, pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.

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2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet (15 m) from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

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1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

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3.5 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 4.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 4 level of administration.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

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a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

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END OF SECTION 271513

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SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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. 50/125-micrometer, multimode optical-fiber cabling.
2. Fire alarm wire and cable.
3. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. IDC: Insulation displacement connector.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

E. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

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1. Installation data for optical-fiber cables as specified in TIA 569-C-1.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:

   a. Cross-connects.
   b. Patch panels.
   c. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical-fiber cable to determine the continuity of the strand, end to end. Use optical-fiber flashlight or optical loss test set.
2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length, and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 OPTICAL-FIBER CABLE

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. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden Inc.
3. Berk-Tek Leviton; a Nexans/Leviton alliance.
4. CommScope, Inc.
5. Corning Cable Systems.
6. Draka Cableteq USA; a Prysmian Group company.
7. General Cable Technologies Corporation.
8. Mohawk; a division of Belden Networking, Inc.
9. Superior Essex Inc.
10. West Penn Wire.

B. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical-fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAB for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. General Purpose, Nonconductive: Type OFN or Type OFNG, or Type OFNR, Type OFNP.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR or Type OFNP, complying with UL 1666.

5. Conductive cable shall be aluminum armored type.
6. Maximum Attenuation: 3.50 db/km at 850 nm; 1.5 db/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.

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3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.4 OPTICAL-FIBER CABLE HARDWARE

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. 3M.
2. ADC.
3. American Technology Systems Industries, Inc.
4. AMP NETCONNECT; a TE Connectivity Ltd. company.
5. Belden Inc.
6. Berk-Tek Leviton; a Nexans/Leviton alliance.
7. Corning Cable Systems.
8. Hubbell Incorporated.
9. Leviton Manufacturing Co., Inc.
10. Molex Premise Networks.
11. West Penn Wire.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

D. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA-604-12. Comply with TIA-568-C.3.

1. Quick-connect, simplex and duplex, Type SC, Type ST, Type LC or Type MT-RJ connectors. Insertion loss not more than 0.75 db.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.5 FIRE ALARM WIRE AND CABLE

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. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Comtran Corporation.
4. Draka Cableteq USA; a Prysmian Group company.
5. Genesis Cable Products; Honeywell International, Inc.
6. Rockbestos-Suprenant Cable Corp.

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7. Superior Essex Inc.
8. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than 16 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

2.6 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

A. Factory test optical-fiber cables on reels according to TIA-568-C.1.

B. Factory test multimode optical fiber cables according to TIA-526.14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

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PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 3/4 inch. Control and data-transmission wiring shall not share conduits with other building wiring systems.

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring on Racks and within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
2. Install lacing bars and distribution spools.
3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

D. Install UTP, optical-fiber, and coaxial cables and connecting materials after spaces are 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.

E. General Requirements for Cabling:

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1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 6 inches of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Maintain minimum cable bending radius during installation and termination of cables.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.
9. Riser Cable: Riser cable support intervals shall be in accordance with manufacturer's recommendations.
10. Comply with Section 280544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

F. Optical-Fiber Cable Installation:

1. Comply with TIA-568-C.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

G. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart. Cable supports shall be fastened to structural members or floor slabs in accordance with Section 260529 "Hangers and Supports for Electrical Systems."
3. Cable shall not be run in contact with pipes, ducts, or other potentially damaging items. Cables shall not be run through structural members or use structural members, pipes, ducts, or equipment as a support.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

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c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method:

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
3. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
4. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different

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colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

A. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-C, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."

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3.9 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect UTP and optical-fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

    a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical-Fiber Cable Tests:

    a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
        2) Attenuation test results for links shall be less than 2.0 db. Attenuation test results shall be less than that calculated according to equation in TIA-568-C.1.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

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E. Prepare test and inspection reports.

END OF SECTION 280513

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SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Fire alarm wire and cable.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

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1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.

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2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

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1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Heat Detectors, and Carbon Monoxide Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Provide all necessary hardware and programming to provide the client with 20% spare capacity on all initiating and indicating circuits.
9. Provide as part of the base contract all labor and materials to install ten (10) additional fire alarm devices during construction. The ten (10) fire alarm device can be but not limited to smoke detector, heat detector, door holder, duct detector, fan shutdown, tamper switches, flow switches, etc. Include all labor and materials including wire, boxes, conduit, terminations, hardware, software, programming and testing.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.10 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

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B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission andhorn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

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E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Carbon monoxide detector.
3. Elevator shunt-trip supervision.
4. User disabling of zones or individual devices.
5. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator 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.

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9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.

F. Elevator shaft or elevator machine room heat detector signal shall initiate the following actions in addition to the action indicated above:

1. Activate elevator shunt trip. There shall be a delay in the activation of the power shunt trip. This delay will be the time it takes the elevator to travel from the top of the hoist way to the lowest recall level.

G. Signal from carbon monoxide detector shall initiate the following actions:

1. Initiate supervisory signal to system and records at the main panel and remote annunciator.
2. Transmits a (supervisory) carbon monoxide signal to central station.
3. Continuously operate sounder base associated with the carbon monoxide detector.
4. Continuously operate carbon monoxide alarm audio/visual notification devices.

2.3 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements all equipment shall be Siemens Cerberus™ PRO FC-922 by Open system Metro In order to assure the Owner of all factory warranties, all equipment shall be obtained from an approved factory authorized distributor. The manufacturer and/or his authorized distributor shall show satisfactory evidence that he maintains a fully equipped factory authorized service organization, stocked with factory approved replacement parts and is capable of furnishing adequate inspection and service of equipment.

1. Provided and subject to compliance with requirements herein, the following alternate manufacturers are approved:

a. Notifier a GE-Honeywell Company
b. EST, UTC Fire & Security, A United Technologies Company

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

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a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 0.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One dedicated RS 485 port for central-station operation using point ID DACT.
b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
c. One USB port for PC configuration.

E. Notification-Appliance Circuit:

1. FIRE ALARM: Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. CARBON MONOXIDE ALARM: Audible appliances shall sound in a four-pulse temporal pattern, as defined in NFPA 72, or a constant tone. Carbon monoxide alarm sound shall be different than the fire alarm sound.

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3. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
4. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, and supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

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L. The system shall support H or O -series devices and Siemens Cerberus™ PRO series devices.

M. The system shall be capable of remote monitoring via Siemens Cerberus™ PROView®, a proprietary software system that provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Devices shall be compatible with new Fire Alarm control panel. Subject to compliance with requirements, provide products by the following:

1. Siemens Cerberus or approved equal.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Devices shall be compatible with new Fire Alarm control panel. Subject to compliance with requirements, provide products by the following:

1. Siemens Cerberus or approved equal

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
   a. Multiple levels of detection sensitivity for each sensor.

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b. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).
3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.
9. Provide with sounder bases for local audio annunciation.

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2.7 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.8 HEAT DETECTORS

A. Manufacturers: Devices shall be compatible with new Fire-Lite Alarms control unit. Subject to compliance with requirements, provide products by the following:

1. Siemens Cerberus or approved equal

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

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2.9 NOTIFICATION APPLIANCES

A. Manufacturers: Devices shall be compatible with new Fire-Lite Alarms control unit. 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. System Sensor.
2. Wheelock; a brand of Eaton.

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate:

   a. Fire alarm unit: Factory finished, red with “FIRE” in white letters.
   b. Carbon monoxide unit: Factory finished, white with “CARBON MONOXIDE” in blue letters.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

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3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall

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initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.14 FIRE ALARM WIRE AND CABLE

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. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

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D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

E. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

F. All conductors and cables run exposed shall be plenum rated.

G. Fire alarm wire and cable shall be New York City certified and listed for 150°C minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to new control panel in new part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.

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3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

E. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

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K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Box covers shall be painted red enamel.

3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method:

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
3. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
4. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Paint fire alarm system junction boxes and covers red.

F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function

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3.5 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to fire suppression system in kitchen.
2. Smoke dampers in air ducts of designated HVAC duct systems.
3. Magnetically held-open doors.
4. Electronically locked doors and access gates.
5. Alarm-initiating connection to elevator recall system and components.
6. Supervisory connections at valve supervisory switches.
7. Supervisory connections at elevator shunt-trip breaker.
8. Data communication circuits for connection to building management system.
9. Supervisory connections at fire-extinguisher locations.
10. Existing zoned annunciation circuits.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.7 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.8 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

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2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DEMONSTRATION

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

END OF SECTION 284621.11

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 315723 "Temporary Stormwater Pollution Control" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at.

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1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

3. Trees to be removed are indicated on the Contract Plans. Trees to be removed shall be Flagged in the field prior to starting tree removal.

B. Topsoil stripping and stockpiling program.

C. Burning: Not Permitted.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Comply with the NYSDOT Work Zone Traffic Control Plan during work within the NYS Right of Way.

2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 315639 "Temporary Tree and Plant Protection."

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 315639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 315639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 315639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

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B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

C. Removal of underground utilities is included in earthwork sections;

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. Dispose of off-site.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Grind down stumps and remove roots larger than in diameter, obstructions, and debris to a depth of below exposed subgrade.

3. Use only hand methods or air spade for grubbing within protection zones.

4. Chip removed tree branches and.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to.

2. Do not stockpile topsoil within protection zones.

3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

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A. Remove foundations, slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, unsuitable soils, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is prohibited. Burning of other waste and debris is also prohibited.

END OF SECTION 311000

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SECTION 312000 - EARTH MOVING (SITE/CIVIL)

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
3. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

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D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.

2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

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1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.

b. Coordination of Work with utility locator service.

c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.

d. Extent of trenching by hand or with air spade.

e. Field quality control.

1.5 ACTION SUBMITTALS

A. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.

2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.

2. Laboratory compaction curve according to ASTM D698 ASTM D1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

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1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 315639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Foot traffic.

4. Erection of sheds or structures.

5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Recycled: No recycled imported materials are permitted.

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C. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487 Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

D. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

E. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

H. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

K. Sand: ASTM C33/C33M; fine aggregate.

L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.

2. Survivability: As follows:

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a. Grab Tensile Strength: 157 lbf; ASTM D4632.

b. Sewn Seam Strength: 142 lbf; ASTM D4632.

c. Tear Strength: 56 lbf; ASTM D4533.

d. Puncture Strength: 56 lbf; ASTM D4833.

3. Apparent Opening Size: sieve, maximum; ASTM D4751.

4. Permittivity: per second, minimum; ASTM D4491.

5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.

2. Survivability: As follows:

a. Grab Tensile Strength: 247 lbf; ASTM D4632.

b. Sewn Seam Strength: 222 lbf; ASTM D4632.

c. Tear Strength: 90 lbf; ASTM D4533.

d. Puncture Strength: 90 lbf; ASTM D4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.

4. Permittivity: 0.02 per second, minimum; ASTM D4491.

5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting , low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type II .

2. Fly Ash: ASTM C618, Class C or F.

3. Normal-Weight Aggregate: ASTM C33/C33M, nominal maximum aggregate size.

4. Foaming Agent: ASTM C869/C869M.

5. Water: ASTM C94/C94M.

6. Air-Entraining Admixture: ASTM C260/C260M.

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B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C138/C138M.

2. Compressive Strength: 140 psi , when tested according to ASTM C495/C495M.

C. Produce conventional-weight, controlled low-strength material with compressive strength when tested according to ASTM C495/C495M.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

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1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.

c. 6 inches outside of minimum required dimensions of concrete cast against grade.

d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches beneath bottom of concrete slabs-on-grade.

f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

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2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

   a. 24 inches outside of concrete forms other than at footings.

   b. 12 inches outside of concrete forms at footings.

   c. 6 inches outside of minimum required dimensions of concrete cast against grade.

   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

   e. 6 inches beneath bottom of concrete slabs-on-grade.

   f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

   1. Clearance: 12 inches each side of pipe or conduit .

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

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3. Cut and protect roots according to requirements in Section 315639 "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction , repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

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2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring, bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Where specified place initial backfill of controlled low-strength material to a height of12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

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1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use engineered fill.

3. Under steps and ramps, use engineered fill.

4. Under equipment slabs, use engineered fill.

5. Under utilities, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698 ASTM D1557:

1. Under structures, equipment slabs, steps, and pavements, scarify and recompact top12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.

3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

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1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch .

2. Walks: Plus or minus 1 inch .

3. Pavements: Plus or minus 1/2 inch .

3.16 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.

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4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.

5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698 ASTM D1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D698 ASTM D1557.

3.18 DRAINAGE COURSE UNDER CONCRETE EQUIPMENT SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place drainage course 6 inches or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material classification and maximum lift thickness comply with requirements.

3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

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C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Equipment Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every2000 sq. ft. or less of paved area or slab but in no case fewer than three tests.

2. Wall Backfill: At each compacted backfill layer, at least one test for every100 feet or less of wall length but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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SECTION 312319 - DEWATERING

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 construction dewatering.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.

3. Review geotechnical report.

4. Review proposed site clearing and excavations.

5. Review existing utilities and subsurface conditions.

6. Review observation and monitoring of dewatering system.

1.4 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.6 FIELD CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 015000 "Temporary Facilities and Controls," during dewatering operations.

3.2 INSTALLATION

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A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend

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construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

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SECTION 314119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected site elements.

B. Related Requirements:

1. Section 315639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.

2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site .

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review areas where existing construction is to remain and requires protection.

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.7 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

3.2 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Masonry: Demolish in small sections and then remove masonry.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

END OF SECTION 314119

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SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

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 temporary excavation support and protection systems.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 312000 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review abandonment or removal of excavation support and protection system.

1.4 ACTION SUBMITTALS

A. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

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1.6 FIELD CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks, and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with requirements of authorities having jurisdiction.
3. Compliance with utility company requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

3.2 INSTALLATION - GENERAL

A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

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3.3 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
3. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment .

B. Install wood lagging within flanges of soldier piles as excavation proceeds.

1. Trim excavation as required to install lagging.
2. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.4 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.

1. Limit vertical offset of adjacent sheet piling to 60 inches.

2. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment .

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.5 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

2. Install internal bracing if required to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 MAINTENANCE

A. Monitor and maintain excavation support and protection system.

B. Prevent surface water from entering excavations by grading, dikes, or other means.

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C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

3.7 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.

1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.

2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.8 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.

1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

2. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction, and abandon remainder.

3. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."

4. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

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SECTION 315639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by at a height 54 inches above the ground line.

B. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
   b. Arborist's responsibilities.
   c. Quality-control program.
   d. Coordination of Work and equipment movement with the locations of protection zones.
   e. Trenching by hand or with air spade within protection zones.

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1.5 ACTION SUBMITTALS

A. Samples: For each type of the following:

1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components .

B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Location on site plan. Include unique identifier for each.
2. Reason for pruning.
3. Description of pruning to be performed.
4. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located .

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work

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without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames and ignition sources, within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil from location shown on Drawings of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil .
2. Planting Soil: Planting soil as specified in

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood .
2. Size Range: 3 inches maximum, 1/2 inch minimum .
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or

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stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

a. Height: 48 inches .

b. Color: High-visibility orange, nonfading.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas as required. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.
2. Install temporary root protection matting over mulch to the extent indicated.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
2. Access Gates: Install ; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range.

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B. Maintain protection-zone fencing in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as shown on Drawings

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends .
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots of the protection zone by cleanly cutting all roots to the depth of the required excavation.

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C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured,broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless required due to damage.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and as indicated on Drawings.
   a. Type of Pruning: Cleaning where indicated.
   b. Specialty Pruning: Structural restoration where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and spread over areas identified by Architector dispose of off-site .

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

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3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

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SECTION 315723 - TEMPORARY STORMWATER POLLUTION CONTROL

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. Temporary stormwater pollution controls.

1.3 STORMWATER POLLUTION PREVENTION PLAN

A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Meet with Owner, Architect, Construction Manager,regulatory authorities and earthwork subcontractor.
2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.

B. Inspection reports.

1.6 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.

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2. SWPPP Coordinator shall be responsible for daily inspections and maintaining of all requirements of the SWPPP. Owners Engineer shall provide weekly inspections and reporting.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP and Contract Plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.

D. Restore and stabilize areas disturbed during construction. Remove SWPPP controls at completion of construction and after issuance of Notice of Termination from NYSDEC and NYCDEP.

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SECTION 323000 - CAST-IN-PLACE CONCRETE

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. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for steel reinforcing bars and welded-wire reinforcement.

2. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

3. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.

b. Construction joints, control joints, isolation joints, and joint-filler strips.

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c. Cold and hot weather concreting procedures.

d. Concrete finishes and finishing.

e. Curing procedures.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.

2. Fly ash.

3. Slag cement.

4. Aggregates.

5. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

6. Curing materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.

2. Minimum 28-day compressive strength.

3. Slump limit.

4. Air content.

5. Nominal maximum aggregate size.

6. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

7. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.

8. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.

9. Intended placement method.

10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Curing compounds.

4. Bonding agents.

5. Adhesives.

6. Vapor retarders.

7. Semirigid joint filler.

8. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.

2. Fly ash.

3. Slag cement.

4. Blended hydraulic cement.

5. Performance-based hydraulic cement.

6. Aggregates.

7. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

1.7 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

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1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

C. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

3. Do not use frozen materials or materials containing ice or snow.

4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.

5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.

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

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301unless modified by requirements in the Contract Documents.

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2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.

2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.

3. Obtain aggregate from single source.

4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type III , white.

2. Fly Ash: ASTM C618, Class C or F.

3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.

b. Ambient Temperature between 50 deg F and 85 deg F: Any color.

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c. Ambient Temperature Above 85 deg F: White.

B. Water: Potable or complying with ASTM C1602/C1602M.

C. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Euclid Chemical Company (The); an RPM company.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, in accordance with ASTM D2240.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.

2. Slag Cement: 50 percent by mass.

3. Silica Fume: 10 percent by mass.

4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

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3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

4. Use permeability-reducing admixture in concrete mixtures where indicated.

2.6 CONCRETE MIXTURES

A. Class A : Normal-weight concrete used for footings and equipment slabs .

1. Exposure Class: ACI 318.

2. Minimum Compressive Strength: at 28 days.

3. Slump Limit:.

4. Slump Flow Limit: 22 inches , plus or minus 1.5 inches .

5. Air Content:

a. Exposure Classes F2 and F3:.

6. Limit water-soluble, chloride-ion content in hardened concrete to percent by weight of cement.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.

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4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.

2. Place joints perpendicular to main reinforcement.

a. Continue reinforcement across construction joints unless otherwise indicated.

b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.4 CONCRETE PLACEMENT

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A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.

2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.

b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.

c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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. Do not place concrete floors and slabs in a checkerboard sequence.

2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

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3. Maintain reinforcement in position on chairs during concrete placement.

4. Screed slab surfaces with a straightedge and strike off to correct elevations.

5. Level concrete, cut high areas, and fill low areas.

6. Slope surfaces uniformly to drains where required.

7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.

8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.

b. Remove projections larger than 1/8 inch.

c. Patch tie holes.

d. Surface Tolerance: ACI 117 Class A.

e. Locations: Apply to concrete surfaces.

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

2. Coordinate required final finish with Architect before application.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.

2. Mix, place, and cure concrete, as specified, to blend with in-place construction.

3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

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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:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.

3. Minimum Compressive Strength: at 28 days.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices.

a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

b. Cast anchor-bolt insert into bases.

c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.

2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.

3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.

2. If forms remain during curing period, moist cure after loosening forms.

3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

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a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.

b. Continuous Sprinkling: Maintain concrete surface continuously wet.

c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.

d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.

2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.

3.9 TOLERANCES

A. Conform to ACI 117.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least month(s).

2. 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 joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.

2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

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B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 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 in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.

b. Make edges of cuts perpendicular to concrete surface.

c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.

d. Fill and compact with patching mortar before bonding agent has dried.

e. 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 matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

a. Correct low and high areas.

b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including 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.

3. After concrete has cured at least 14 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

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a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to remain exposed with repair topping.

a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.

b. Prepare, mix, and apply repair topping and primer in accordance with 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.

a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.

b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.

d. Place, compact, and finish to blend with adjacent finished concrete.

e. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.

b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.

d. Compact patching mortar and finish to match adjacent concrete.

e. 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.

3.12 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

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B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.

2) Name of testing agency.

3) Names and certification numbers of field and laboratory technicians performing inspections and testing.

4) Name of concrete manufacturer.

5) Date and time of inspection, sampling, and field testing.

6) Date and time of concrete placement.

7) Location in Work of concrete represented by samples.

8) Date and time sample was obtained.

9) Truck and batch ticket numbers.

10) Design compressive strength at 28 days.

11) Concrete mixture designation, proportions, and materials.

12) Field test results.

13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.

14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

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D. Inspections:

1. Curing procedures and maintenance of curing temperature.

2. Verification of concrete strength before removal of shores and forms from beams and slabs.

3. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.

b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

a. Test one set of laboratory-cured specimens at seven days and one set of two specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

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7. Strength of each concrete mixture 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

8. 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.

9. Additional Tests:

   a. 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.

   b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

      1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 PROTECTION

A. Protect concrete surfaces as follows:

   1. Protect from petroleum stains.

   2. Prohibit placement of steel items on concrete surfaces.

   3. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 323000

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SECTION 321216 - ASPHALT PAVING

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. Hot-mix asphalt paving.

2. Cold milling of existing asphalt pavement, required where meeting existing pavement.

B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.

b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

A. Hot-Mix Asphalt Designs:

1. For each hot-mix asphalt design proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates:

1. Aggregates.

2. Asphalt cement.

3. Tack coat.

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1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 40 deg F.

2. Tack Coat: Minimum surface temperature of 40 deg F.

3. Asphalt Base Course and Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation [**PG 64-22**] .

B. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

C. Water: Potable.

2.3 AUXILIARY MATERIALS

2.4 MIXES

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A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction ; designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods"; and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

2. Base Course: NYSDOT Item # 402.378903.

3. Binder Course: NYSDOT Item #402.258903.

4. Surface Course: NYSDOT Item # 402.128103.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction with 10 Ton minimum Roller. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of.

2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.

3. Control rate of milling to prevent tearing of existing asphalt course.

4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.

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5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.

6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.

7. Handle milled asphalt material in accordance with approved waste management plan.

8. Keep milled pavement surface free of loose material and dust.

9. Do not allow milled materials to accumulate on-site.

3.4 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course and binder coursein number of lifts and thicknesses indicated within Contract Plans.

2. Place hot-mix asphalt surface course in single lift of thickness indicated within Contract Plans.

3. Spread mix at a minimum temperature of 250 deg F.

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.

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2. Complete a section of asphalt base course and binder course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

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E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course and Binder Course: Plus or minus 1/4 inch.

2. Surface Course: Plus 1/8 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course and Binder Course : 1/4 inch .

2. Surface Course: 1/8 inch .

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.

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2. In-place density of compacted pavement will be determined by testing in accordance with ASTM D1188 or ASTM D2726/D2726M.

    a. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan.

END OF SECTION 321216

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SECTION 321313 - CONCRETE PAVING

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 Concrete Paving Including the Following:

1. Curbs.

2. Walks.

B. Related Requirements:

1. Section 323000 "Cast-in-Place Concrete" Section 033053 "Miscellaneous Cast-in-Place Concrete"for general applications of concrete.

2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

3. Section 321726 "Tactile Warning Surfacing" for detectable warning.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.

b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

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c. Ready-mix concrete manufacturer.

d. Concrete paving Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer of stamped detectable warnings ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.

3. Admixtures.

4. Curing compounds.

5. Applied finish materials.

6. Bonding agent or epoxy adhesive.

7. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

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B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated fromsteel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

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C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

E. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, Grade 60 deformed bars.

F. Plain-Steel Wire: ASTM A1064/A1064M, .

G. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated, plain deformed.

H. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars ; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

I. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.

J. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

K. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

L. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

M. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

N. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, white portland cement Type II .

B. Normal-Weight Aggregates: ASTM C33/C33M,, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

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1. Maximum Coarse-Aggregate Size: nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: nominal.

D. Air-Entraining Admixture: ASTM C260/C260M, Euclid Chemical Company Eucon AEA92.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D Euclid Chemical Company, Eucon WR91.

F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Euclid Chemical Company (The); an RPM company.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber ASTM D1752, cork or self-expanding cork or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.

B. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. , for bonding hardened or freshly mixed concrete to hardened concrete.

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C. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Euclid Chemical Company (The); an RPM company.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Slag Cement: 50 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 1-inchNominal Maximum Aggregate Size: percent plus or minus 1-1/2 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use 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.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days):.

2. Maximum W/C Ratio at Point of Placement:.

3. Slump Limit:, plus or minus 1 inch.

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2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.

2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

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E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Butt Joints: Use at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

a. Tolerance: Ensure that sawed joints are within either way from centers of dowels.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation , steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies , reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

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K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 INSTALLATION OF DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size:.

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

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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, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.

3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.

4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

5. Lateral Alignment and Spacing of Dowels: 1 inch.

6. Vertical Alignment of Dowels: 1/4 inch.

7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.

8. Joint Spacing: 3 inches.

9. Contraction Joint Depth: Plus 1/4 inch, no minus.

10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

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1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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.

D. 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 mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. 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.

F. 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.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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I. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

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SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

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. Cold-applied joint sealants.

2. Joint-sealant backer materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer .

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD 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 deg F.

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.

PART 2 - PRODUCTS

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2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, 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.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. The Dow Chemical Company.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints 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: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

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3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint 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 joint-sealant backings.

2. Do not stretch, twist, puncture, or tear joint-sealant backings.

3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact 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.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. 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

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protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:

a. Expansion and isolation joints in concrete paving.

b. Contraction joints in concrete paving.

c. Other joints as indicated.

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SECTION 321723 - PAVEMENT MARKINGS

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. Painted markings applied to asphalt paving.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to marking asphalt paving surfaces including, but not limited to, the following:

a. Asphalt-paving surface aging period before application of pavement markings.

b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, alkyd.

2. Glass beads.

B. Shop Drawings:

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.

2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of for pavement-marking work.

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1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials , and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dow Chemical Company (The).

2. PPG Paints.

3. Sherwin-Williams Company (The).

B. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.2 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 .

2.3 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952F.

1. Color: White Yellow Blue .

B. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1 , made of 100 percent recycled glass.

1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

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3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils .

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

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SECTION 321726 - TACTILE WARNING SURFACING

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. Cast-in-place detectable warning metal tiles.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at.

1.7 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

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1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing , joint material , setting material , anchor , and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Access Products, Inc.

b. ADA Solutions, LLC.

c. AlertTile; a division of Cape Fear Systems, II, LLC.

2. Material: Cast-fiber-reinforced polymer concrete tile .

3. Color:.

4. Shapes and Sizes:

a. Rectangular panel,.

5. Dome Spacing and Configuration:, in pattern.

6. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

b. Detectable warning tile set into formed recess in concrete and adhered with.

c. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

B. Cast-in-Place Detectable Warning Metal Tiles: Accessible truncated-dome detectable warning metal tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADA Solutions, LLC.

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b. Advantage Tactile Systems.

2. Material:

a. Stainless-Steel Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 .

1) Finish and Color:

a) Manufacturer's standard powder coat,.

b) Mill finish.

3. Shapes and Sizes:

a. Rectangular panel,.

4. Dome Spacing and Configuration:, in pattern.

5. Mounting:

a. Permanently embedded detectable warning tile set into formed recess in concrete and adhered with mortar .

b. Replaceable embedded detectable warning tile fastened to permanently installed anchors.

2.3 ACCESSORIES

A. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

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A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.

2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.

3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.

4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.

5. Clean tiles using methods recommended in writing by manufacturer.

B. Removable Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.

2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.

3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.

4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.

5. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

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SECTION 323119 - DECORATIVE FENCING AND TIMBER GUIDE RAIL

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. Decorative Vinyl fences.
2. Decorative Vinyl Gates.
3. Timber Guide Rail

B. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete.

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. Shop Drawings:

1. Fence and Gates: Include plans, elevations, sections, gate locations, post spacing, and mounting details.
2. Timber Guide Rail: Include plans, details and mounting/connections.

C. Samples: For fence material, finish and color specified.

1.5 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fence: Wind Loading:

1. Fence Height: Six (6) feet.
2. Design Wind Speed: Illusion 75 MPH Wind Adaptor Kit.

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3. Design Wind Pressure: 75MPH .

2.2 DECORATIVE VINYL FENCES

A. Decorative Vinyl Fences: Illusion V300-6 six (6) foot high Tongue and Groove Privacy Fence made from 100% Pure Virgin Vinyl compliant with ASTM F964-13.

1. Illusion Fence Company

B. Posts: 100% Pure Virgin Vinyl Square extruded tubes.

1. Line Posts: 5 inch x 5 inch VH-55 Post with Post Cap .

2. End and Corner Posts: 8 inch x 8 inch V-88 Post with Post Cap .

3. Swing Gate Posts: 8 inch x 8 inch V-88 Post with Post Cap.

C. Post Caps: 100% Pure Virgin Vinyl.

D. Rails: 100% Pure Virgin Vinyl. 1 1/2 inch x 5 1/2 inch Top and Bottom Rails with 7/8 inch x 1 inch U-Channel Edging.

E. Boards: 100% Pure Virgin Vinyl. 6 foot High with 7/8 inch x 6 inch Boards.

F. Fasteners: Manufacturer's standard concealed fastening system.

G. Finish to be Wood Grain appearance and Classic Beige Color. Final style and color to be chosen by Architect.

2.3 SWING GATES

A. Gate Configuration: Double leaf .

B. Gate Frame Height: Six (6) feet.

C. 100% Pure Virgin Vinyl matching decorative fence.

D. Frame Construction: Uni-Weld corners with internal truss rods in each horizontal member [**or**] [**assembled with corner fittings**] [**and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider**].

E. Additional Rails: Provide as indicated, complying with requirements for fence rails.

F. Board Size, Configuration, and Spacing: Comply with requirements for fence.

G. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf . Provide center gate stops and cane bolts for pairs of gates.

H. Hinges: Illusion VDG 3701-56 X-Tra Strong L- Hinges. 15 inches long x 7.75 inches high with adjusting screw.

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I. Cane Bolts: DRAS-48, 48 inch Drop Rods. Provide both gates. Provide galvanized-steel pipe strikes to receive cane bolts in.

J. Aluminum Finish: Baked enamel or powder coating.

2.4 Vinyl

A. Vinyl, General: Provide 100% Pure Virgin Vinyl. Complying with ASTM F964-13,.

B. Extrusions:Rigid Poly Vinyl Chloride (PVC) meeting requirements of ASTM D4216,

2.5 MISCELLANEOUS MATERIALS

A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 323000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

B. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 TIMBER GUIDE RAIL

A. Rough Sawn Timber Post: 10" x 12" Pressure Treated Wood Post, driven to a minimum depth of 6 feet below grade.

B. Rough Sawn Timber Rail: 4" x 12" Pressure Treated Wood Rail connected at post with Steel Splice Plate.

C. Splice Plate: 10" x 30" x 5/8" steel splice plate between rails and fastened to each post. Fasten plate to each rail with four (4) 3/4" carriage bolts, hex nut and washer. Plate and rails fastened to each post with two (2) 5/8" carriage bolts, hex nuts and washer.

D. Terminal Sections: Terminal section along driveway shall taper to ground elevation within an 18 foot taper.

E. Timber Components: All components shall be #1 Grade Southern Pine, S4S, in accordance with Southern Pine Inspection Bureau and pressure treated in accordance with American Wood Preservers Standard C14.

F. Steel: All splice plates shall be in accordance with ASTM A588 Weathering Steel.

G. All fasteners shall conform with ASTM, carriage bolts A307, hex nuts A 563, and washers F436.

PART 3 - EXECUTION

3.1 EXAMINATION

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A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 50 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.

b. Concealed Concrete: Top below grade as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

4. Space posts uniformly.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

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A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.6 GUIDE RAIL INSTALLATION

A. POSTS: It is perferred that posts be driven with a commercial grade post driver. In the alternative posts posts may be installed with an auger hole, backfilling and compacting in 12 inch maximum lifts, avoiding any settlement and maintaining plumb, proper alignment and spacing.

B. RAILS: Shall be installed at a uniform height and alignment. All bolt holes shall be drilled using a template to assure uniform spacing. Hex nuts shall be recessed at all posts. Excess bolt length along rails shall be cut to avoid protruding ends. Bolt heads shall be rounded along face of rail and installed with a washer.

C. TERMINAL ENDS: Terminal ends along driveway shoulder shall transition from full height to grade and taper away from travel way, over a minimum length of 18 feet.

END OF SECTION 323119

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SECTION 323223 - SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes single- depth segmental retaining walls without soil reinforcement.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation for segmental retaining walls.

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 color and texture of concrete unit specified. Submit full-size units .

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of segmental retaining wall unit from manufacturer.

1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

B. Product Test Reports: For each type of segmental retaining wall unit, for tests performed by a qualified testing agency.

1. Include test data for freeze-thaw durability of segmental retaining wall units.

2. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.

1. Build mockup of segmental retaining wall.

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a. Include typical base and cap or finished top construction.

b. Include typical end construction at one end of mockup.

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

1.7 PRECONSTRUCTION TESTING

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.

PART 2 - PRODUCTS

2.1 Precast Concrete Modular Gravity Retaining Wall: Ledgestone Blocks by Redi-Rock International, LLC

2.2 PERFORMANCE REQUIREMENTS

A. Basis of Design: Design of segmental retaining walls is based on products indicated. If comparable products of another manufacturer are proposed, engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design segmental retaining walls.

2.3 INSTALLATION MATERIALS

A. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base drainage course.

B. Drainage Fill: Comply with requirements in Section 312000 "Earth Moving" for drainage course.

C. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

D. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

E. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.

1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D 4751.

2. Minimum Grab Tensile Strength: 110 lb; ASTM D 4632.

3. Minimum Weight: 4 oz./sq. yd..

PART 3 - EXECUTION

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3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RETAINING WALL INSTALLATION

A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and Redi- Rock International, LLC written instructions.

1. Lay units in bond pattern indicated.

2. Form corners and ends by.

B. Do not use units with chips, cracks, or other defects that are visible at a distance of 20 feet where such defects are exposed in the completed Work.

C. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.

D. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.

1. Tamp units into leveling base as necessary to bring tops of units into a level plane.

E. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.

1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.

F. Cap Units: Place cap units.

3.3 FILL PLACEMENT

A. General: Comply with requirements in Section 312000 "Earth Moving," with NCMA's "Segmental Retaining Wall Installation Guide," and with Redi-Rock International, LLC written instructions.

B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.

C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall, and place and spread fills toward embankment.

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1. Use only hand-operated compaction equipment within 48 inches of wall, or one-half of height above bottom of wall, whichever is greater.

2. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."

D. Place drainage geotextile against back of wall, and place layer of drainage fill at least 12 inches wide behind drainage geotextile to within 12 inches of finished grade. Place another layer of drainage geotextile between drainage fill and soil fill.

E. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated , sloped not less than 0.5 percent to drain.

F. Place impervious fill over top edge of drainage fill layer.

G. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at wall base away from wall. Provide uniform slopes that prevent ponding.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet, 3 inches maximum.

B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet.

C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.

D. Maximum Gap between Units: 1/8 inch.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Comply with requirements in Section 312000 "Earth Moving" for field quality control.

1. In each compacted backfill layer, perform at least one field in-place compaction test for each 150 feet or less of segmental retaining wall length.

3.6 ADJUSTING

A. Remove and replace segmental retaining wall construction of the following descriptions:

1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.

2. Segmental retaining walls that do not match approved Samples and mockups.

3. Segmental retaining walls that do not comply with other requirements indicated.

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B. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 323223

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SECTION 329200 MEADOW SEEDING (UPLAND AND BIORENTETION BASIN MIXES)

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 work of this Section.

B. Related Work Specified Elsewhere:

1. Landscaping 329300

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials, tools, equipment, and services necessary for and reasonably incidental to complete the installation of seeded areas (Mix C) as shown on the drawings, or specified, including, but not limited to the following:

1. Soil preparation
2. Installation of meadow planting
3. Establishment period
4. Guarantee

B. All meadow installations specified in this section and on the drawings shall be in addition to lawn type and installation performed for soil erosion, dust control, or construction stabilization purposes during construction of the project. Contractor shall provide the specified slope stabilization plantings and meadows in a fully established condition for all areas of the project within the contract limit line and areas of disturbance.

1.3 QUALITY ASSURANCE

A. Installation of meadows and related work shall be performed by a firm with a minimum of five years' experience specializing in this type of work.

B. Contractor shall be responsible for obtaining all permits and owners approval with regards to the application of any herbicides and removals.

1.4 SUBMITTALS

A. Provide and pay for soil tests for representative site soil samples and topsoil to be used. Tests shall show pH factor, mechanical analysis, percentage of organic content, recommendations on type and quantity of additives to establish the required pH factor and recommendations for any additional soil additives that are necessary to establish the meadows. Furnish all test results and recommendations to Landscape Architect prior to beginning work. All testing to be done by a qualified testing service laboratory.

B. Submit soil test results to seed supplier: Amend seed mixture as recommended by supplier based on test results.

C. Submit seed vendor's certification for all required seed mixtures, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass and cover crop species.

1.5 PROJECT CONDITIONS

A. Work Notification: Notify Landscape Architect at least ten (10) calendar days prior to start of meadow planting installation operations.

B. Protect existing utilities, paving, and other facilities from damage caused by meadow installation operations.

C. Perform meadow installation work only after planting and other work affecting ground surface has been completed.

D. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

E. Restrict traffic from meadows until seeded areas are established. Erect signs and barriers as required.

F. Review site conditions with Landscape Architect to determine dry and moist areas surrounding basin for meadow planting.

1.6 REVIEW AND ACCEPTANCE

A. Final Review and Acceptance:

1. Review to determine final acceptance of meadow area will be made by the Landscape Architect, upon Contractor's written request. Provide notification at least five (5) calendar days before requested review date. Meadow areas will be acceptable provided all requirements, including the establishment period have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects. Upon final acceptance, the Owner will assume meadow maintenance.

1.7 GUARANTEE

A. All meadow areas shall be guaranteed for one year or until final acceptance whichever is longer.

B. The Contractor shall provide a uniform stand of meadow that is healthy, even colored, free of weeds, undesirable grass species, disease, and insects.

C. The Contractor shall repair or reseed without cost to the Owner, all planting areas that are not in the specified acceptable condition. Repair method shall be the same as originally

specified.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Refer to Engineer's drawings and specifications for bio-retention soil specifications at basins where meadow seeding will occur.

B. Topsoil: ASTM D 5268, pH range of 5.5 to 7.0, 4 percent organic material minimum,20% maximum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth including invasive weeds.

1. Imported topsoil from offsite sources shall be obtained from naturally well-drained sites where topsoil occurs at least 4 inches (199 mm) deep; do not obtain from bogs or marshes.

2.

Mechanical Analysis Screen Size	**% By Weight Passing**
1"	100
¼"	97-100
No. 200	20-65

3. Topsoil in which more than 65% of the material passing a No. 200 sieve as determined by the Bouyoucous Hydrometer or by the decantation method, shell be rejected. All percentages based on the dry weight of the samples.

4. On-site topsoil if required may be used for meadow areas if, when amended, its physical and nutrient properties meet the requirements of these specifications.

5. All topsoil suitable shall be kept separate from other material, stored and stocked piled on the site in locations approved by the Owner's field representatives.

C. Lime: Lime material shall be ground agricultural limestone that contains at least 50% total oxides calcium oxide plus magnesium oxide. Ground limestone shall be ground to such a fineness that at least 50% will pass through a 100-mesh sieve and 98 to 100% will pass through a 20-mesh sieve. Lime shall be applied at rates as recommended by seed supplier and as determined by soil testing.

D. Fertilizer: No fertilizers shall be added to meadows unless specifically called out by seed supply company after analysis of soil samples. All fertilizers shall be uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizers shall be delivered to the site fully labeled according to applicable State Fertilizer Laws and shall bear the name, trade name, or trademark and warranty of the producer. Fertilizer should not be typical Lawn Food, but a Low nitrogen fertilizers recommended by the seed supply company for meadow establishment.

E. Seed for Meadows: Seed shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures and pure live seed. Seed shall be labeled in conformance with U.S. Department of Agricultural rules and regulations under the Federal Seed Act. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Shall be supplied by Ernst Conservation Seeds, Inc., 8884 Mercer Pike, Meadville, PA 16335 (1-800-873-3321) or approved equal for bioretention areas and by American Meadows, 2438 Shelburne Road, Shelburne, VT 05482 (1-877-309-7333).

1. Retention Basin Wildlife Mix shall be as follows:

Elymus virginicus ‘PA Ecotype’ (Virginia Wildrye)	22.0%
Poa palustris (Fowl Bluegrass)	22.0%
Carex vulpinoidea ‘PA Ecotype’ (Fox Sedge)	15.0%
Carex lupulina ‘PA Ecotype’ (Hop Sedge)	6.0%
Carex scoparia ‘PA Ecotype’ (Blunt Broom Sedge)	5.0%
Juncus effusus (Soft Rush)	3.0%
Ascelpias incarnata ‘PA Ecotype’ (Swamp Milkweed)	1.0%
Eupatorium perfoliatum ‘PA Ecotype’ (Boneset)	0.50%
Scripus cyperinus ‘PA Ecotype’ (Woolgrass)	0.50%

2. Northeast Native Grass Seed Mix shall be as follows:

Elymus virginicus (Virginia Wildrye)	32%
Panicum virgatum (Switch Grass)	4%

Elymus canadensis (Canada Wildrye)	32%
Schizachyrium scoparium (Little Bluestem)	15%
Sorghastrum nutans (Indiangrass)	17%

F. Inoculants: Provide proper fresh rhizobium inoculum supplied by Preferred Seed Company, Inc., or approved equal.

G. Mulch and Binders:

1. Provide straw mulch over new meadows per New York State Department of Transportation item 713-19. Provide air-dry, clean, mildew, and seed free, salt hay or threshold straw of wheat, rye, oats or barley.

2. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching. Acceptable products include Conwed Hydromulch, Conwed Corp., St. Paul, Minn., Cellin Hydromulch, Cellin Manufacturing, Inc., Lorton, VA or approved equal.

3. Tackifier: Liquid concentrate diluted with water forming a transparent three-dimensional film-like crust permeable to water and containing no agents toxic to seed germination. Acceptable products include Polybind DLR, Celtite, Inc. Cleveland, Ohio; Curasol AK, American Hoechst Corp., Elk Grove, Illinois.

PART 3-EXECUTION

3.1 INSTALLATION SEASON

A. Installation of meadows shall be done only within the following dates:

1. Mix for dry sites can be applied at any time of the year. Mix for moist sites shall be sown between March 15th and May 1st or between August 21st and October 15th with a light mulching of weed free straw to conserve moisture.

3.2 SOIL PREPARATION

A. Examine finish surfaces and grades. Work shall proceed only after subgrade is within 0.10' of final grade, allowing for topsoil depth. Grades on the areas where plantings are to be established shall be maintained in a true and even grade.

B. Loosen subgrade of slope stabilization plantings areas to a MINIMUM DEPTHOF 4". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas that will be planted promptly after preparation.

C. Place approximately ½ the thickness of topsoil if required. Work into top of loosened subgrade to create a transition layer and then spread remainder of topsoil to meet lines, grades, and elevations shown, after light rolling and natural settlement.

D. Apply lime, at a rate determined by a soil test, to adjust the pH of the soil to not less than 6.5 and not more than 7.0. Distribute evenly over the soil and fully incorporate into the soil by tilling.

E. Apply low nitrogen fertilizer, at a rate determined by a soil test, to the soil. Distribute evenly over the soil and fully incorporate into the soil by tilling. Fertilizer application may be incorporated into hydroseeding procedure.

F. Grade slope stabilization plantings areas to a smooth, even surface with loose uniform fine texture. Roll and rake and remove ridges and fill depressions. Restore slope stabilization plantings areas to specified condition if eroded or otherwise disturbed after fine grading and prior to installation of plantings.

3.3 INSTALLATION OF MEADOW

A. Existing on site topsoil may be utilized for meadow areas if test results indicate soil is suitable based on supplier's recommendations. Contractor to add amendments as required. Follow supplier's instructions ridgley for installation of all meadow seed mixes.

1. Provide a freshly rototilled seedbed free of rocks or dirt clumps greater than two inches in diameter.

2. Apply fertilizer only as recommended by seed supplier and as required based on soil testing.

3. Divide the mixture in half and broadcast one half of the seed evenly over site using seed spreader. Apply the second half of the seed evenly over the site in a perpendicular direction. Seed at rates as recommended by seed supplier
4. Cover the seed with one eighth to one fourth inch of soil using a rake, drag, or piece of chain link fence.

5. Roll lightly and water with fine spray.

6. Mulch the designated planting area with approximately one inch of weed-free straw.

B. The Contractor shall provide at his own expenses protection against trespassing and damage to meadow areas. If any areas are damaged, they shall be restored at the Contractor's expense.

3.4 ESTABLISHMENT OF MEADOWS

A. Establishment shall begin immediately after plantings are installed and shall continue until final acceptance. The establishment period is intended to insure that the project is delivered to the Owner with all slope stabilization plantings installed and in full, vigorous health.

B. Maintain seeded areas for a period of 60 days or until final acceptance, whichever is longer. Establishment shall begin after completed installation. Maintain seeding and work incidental thereto by performing the following and all other operations of care for the promotion of growth so that all work meets specifications throughout the establishment period.

1. Watering: Provide all labor and materials for watering operations required for maintenance. During the first week, perform daily watering to keep soil moist at all times and to maintain moist topsoil to a depth of at least four inches. During subsequent weeks, water the seeded areas to maintain adequate moisture in the upper four inches of soil necessary for the promotion of deep root growth. Minimum precipitation rate shall be one inch per week.

2. Mowing: Mow meadow at intervals recommended by the seed supplier.

3. Reseeding: During the establishment period, replace seeded areas that are dead, or are in an unhealthy, unsightly, or badly impaired condition as soon as possible during the specified planting season. Make such replacements in the same manner as specified for the original seeding at no additional cost to the

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 329200

SECTION 329300- LANDSCAPING

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.

B. Related work specified elsewhere

1. Section 329200 Meadow Seeding

1.2 SUMMARY

A. This Section includes the following:

1. Trees, Shrubs, & Ground covers.

2. New Lawn- Seed Mix ‘A’

3. Topsoil and soil amendments

4. Planting Mixes Fertilizers and mulches.

5. Stakes and guys.

6. Mulches, binders, and erosion control blankets.

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 certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.

2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the

botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packing.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.

E. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.

1. Analysis of existing surface soil.

2. Analysis of imported topsoil.

F. Manufacturer’s and suppliers test reports and product data for all mulches, binders and erosion control blankets.

1.4 QUALITY ASSURANCE

A. Standards: Comply with latest specifications and recommendations of New York State Department of Transportation for seeding.

B. Installer Qualifications: Engage an experienced Installer who has completed landscaping work including hydroseeding similar in material, design, and extent to that indicated for this Project and with a record of successful landscape, lawn and meadow establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

D. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce satisfactory topsoil.

E. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub

for height and spread; do not measure branches or roots tip-to-tip.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by the Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

D. Handle balled and burlapped stock by the root ball.

E. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of trees and shrubs stored on site with a fine- mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 PROJECT CONDITIONS

A. Prior to submitting bid, contractor shall visit and familiarize himself with site and scope of work to be done by others. He is advised to examine all existing conditions not shown on drawings or mentioned in specifications, which would affect the cost of work required under the Contract, and to judge for himself conditions which will exist when he carries out his Contract, as he will not be allowed extra compensation for any additional work required thereby.

B. The Contractor shall review the plans showing approximate location of existing and proposed utilities and underground and surface structures. He shall acquaint himself with these features and any damage to them by reason of his performance of work will be his responsibility and shall be repaired at his expense to the satisfaction of the Landscape Architect.

C. Percolation Test: Prior to any tree or shrub planting, the Contractor shall fill a minimum of 25% of the planting pits with water and observe the rate of percolation. If in the opinion of the Contractor, slow percolation indicates a soil condition might endanger the health of materials to be planted, he shall contact the Landscape Architect to establish a mutually acceptable method of providing adequate drainage. Compensation for any necessary drainage provisions shall be at a negotiated price. No claims for additional compensation arising from the loss of plant material due to ground water problems will be accepted unless this procedure is followed.

D. Protection: The Contractor shall provide at his own expense protection against trespassing and damage to all planted and seeded areas. If any areas are damaged, they shall be restored at the Contractor's expense. The Landscape Architect shall approve any means of protection prior to its erection.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during specified planting seasons for each type of plant material required.

1.8 WARRANTY

A. Warrant material and workmanship in accordance with Contract Documents for a period of one year after acceptance or for not less than two full planting seasons, whichever period is greater.

B. During the warranty period, the Contractor shall replace any plant which, for any reason has died or is in a dying condition, or which has failed to flourish in such a manner or to such a degree that its usefulness or appearance has been impaired, and he shall further make good any other damage, loss, impairment or defect in materials or work where the loss, impairment, destruction, or failure to flourish sufficiently is the result of inferior or defective materials of workmanship, or unfavorable weather conditions. The decision of the Landscape Architect as to the necessity of replacing any plants or materials or repair any defects in workmanship or of the cause of any destruction, loss, impairment, or failure to flourish shall be conclusive and binding upon the Contractor. The Contractor shall also make good all damage to persons or property caused by defective workmanship or materials or by the work required to remedy such defects.

C. During the warranty period, the contractor shall from time to time, inspect the maintenance operations carried on by the owner and promptly report to the Landscape Architect any methods, practices or operations which he considers unsatisfactory, and not in accord with his interests or good horticultural practices. The failure of the Contractor to so inspect or report shall be construed as an acceptance by him of the Owner's maintenance operations, and he shall not thereafter claim or assert that any defects which may later develop are the results of such methods, practices or operations.

D. Replacements: All trees, shrubs and ground cover found to be unacceptable, during the warranty period, shall be removed from the site and replaced, with material as originally specified, during the immediate planting season following the Landscape Architect's

notification.

E. Lawn Warranty: Warrant all lawn areas for a period of one year after acceptance. At the end of the warranty period, all areas that are in a dead or dying or have not germinated condition shall be replaced.

1.9 TREE AND SHRUB ESTABLISHMENT

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs until owner acceptance.

1.10 GROUND COVER AND PLANT ESTABLISHMENT

A. Maintain ground cover and plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings until owner acceptance.

1.11 LAWN ESTABLISHMENT

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days or until Substantial Completion whichever is longer.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn- watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).

1. Water lawn at the minimum rate of 1 inch (25 mm) per week.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

1.12 ACCEPTANCE

A. Acceptance: Upon completion of the planting operations, the contractor shall request, in writing, an inspection by the Landscape Architect. If all work is acceptable the Landscape Architect will issue a certificate of acceptance and the one year warranty will begin. If any work is found to be defective or incomplete, the Contractor will not be issued an acceptance certificate.

B. Final Acceptance: At the end of the warranty period, the Contractor shall request an inspection by the Landscape Architect. If all work is found to be acceptable, the Landscape Architect shall authorize payment of the 10% retention. If replacements and/or remedial work are found to be necessary, this work will be completed by the Contractor and approved by the Landscape Architect prior to final payment.

PART 2 - PRODUCTS

2.1 SLOW RELEASE WATER BAGS

A. Slow release watering bags placed at each tree- Treegater as manufactured by Spectrum Products or approved equal.

2.2 TREE AND SHRUB MATERIAL

A. Inspection: All plants shall be subject to inspection and approval by the Landscape Architect. Plants shall be inspected and tagged at the place of growth prior to digging. Inspection and tagging at the place of growth before shipment shall not affect the right to reject such plants if damage has occurred during digging, handling or delivery. Inspection will be for quality and size, variety and color, all other requirements are the responsibility of the Contractor.

The Contractor or his authorized representative shall be present during inspections.

The Contractor shall make a written request to the Landscape Architect ten working days in advance for all inspections at the various nurseries and collecting grounds. State the location of the nursery or collecting grounds and list the particular plants which are to be inspected as well as the sizes and quantities of such plants.

If the plants and materials to be inspected are located outside a 20 mile radius of the project site, the cost of inspection shall be paid for by the Contractor at a per diem rate plus travel, lodging and other out-of- pocket expenses.

B. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

C. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

D. Label a minimum of one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical name and common name. These labels shall remain on plant material until Final Review for Warranty Conformance.

2.3 PLANT MATERIAL

A. General: Refer to the PLANT SCHEDULE on the drawings for specific types and quantities of plants to be furnished.

1. Plants shall be nursery grown in accordance with good horticultural practices and grown under climatic conditions similar to those in the locality of the project for at least two years. They shall have been root pruned within the last two years.

2. Plants shall be freshly dug. No heeled-in plants or plants from cold storage will be accepted.

3. Unless specifically noted otherwise, all plants shall be of specimen quality, exceptionally heavy, symmetrical, tightly-knit plants, so trained or favored in their development and appearance as to be unquestionably and outstandingly superior in form, number of branches, compactness, and symmetry.

4. Plants shall be sound, healthy and vigorous, well-branched and densely foliated when in leaf, free of disease, insect pests, eggs or larvae, and shall have healthy, well-developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving with the specified result.

5. Plants shall be true species and variety and shall conform to measurements specified in the plant schedule except that plants larger than specified may be used if acceptable to the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are accepted the ball of earth shall be increased in proportion to the size of the plant.

6. Container grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together.

2.4 GRASS MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated on Schedules at the end of this Section.

2.5 TOPSOIL

A. .Topsoil: ASTM D 5268, pH range of 5.5 to 7.0, 4 percent organic material minimum,20% maximum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth including invasive weeds.

1. Imported topsoil from offsite sources shall be obtained from naturally well-drained sites where topsoil occurs at least 4 inches (199 mm) deep; do not obtain from bogs or marshes.

2.

Mechanical Analysis Screen Size	**% By Weight Passing**
1”	100
¼”	97-100
No. 200	20-65

3. Topsoil in which more than 65% of the material passing a No. 200 sieve as determined by the Bouyoucous Hydrometer or by the decantation method, shell be rejected. All percentages based on the dry weight of the samples.

4. No on-site topsoil may be used for planting mixture backfill for tree or shrub planting pits or for perennial beds. On-site topsoil may be used for lawn areas if, when amended, its physical and nutrient properties meet the requirements of these specifications.

5. All topsoil suitable shall be kept separate from other material, stored and stocked piled on the site in locations approved by the Owner’s field representatives.

6. If there is not a sufficient quantity of topsoil present on the site the Contractor shall supply from off-site sources the necessary quantity of topsoil to complete the topsoil operations as specified here in or shown on the drawings. All such topsoil shall be furnished and spread as part of the contract sum. No claim for extra compensation by the Contractor will be allowed.

2.5 PLANTING MIXES

A. All planting mixes shall be prepared prior to delivery to site.

1. Planting Mix for Tree and Shrub Pit Planting Mix shall be as follows:

3 parts screened topsoil

1 part clean washed coarse sand

1 part peat humus

5 lbs. super phosphate per cubic yard of mix.

Submit certification of Planting Mix from soil distributor to the Landscape Architect for approval. Certification shall verifying composition of soil after mixing.

2.6 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.

   1. Provide lime in the form of dolomitic limestone.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, coarse, ungraded, meeting ASTM C33 requirements for mason's sand free of toxic materials.

D. Humus: Shall be FS Q-P-166E Type IV natural domestic reed peat or sedge peat, but not peat-moss, free from sticks, stones, weeds, roots or other foreign matter and when delivered from stock piles containing between 35-50% moisture, suitable for mulch and of composition to provide ample water holding capacity and retention of plant food. Dark brown or black in color. Provide humus of the following analysis:

   1. Maximum moisture content 70% by weight.

   2. pH 5.0 to 7.5.

   3. Water absorbing capacity not less than 300% of its own weight (oven dried basis)

   4. Organic matter shall test 80% on a dry weight basis (samples dried at 100 degrees C)

   5. Humus with organic matter of 75%-80% may be accepted, the deficiency to be made up in the quantity.

   6. Low in content of woody material, iron and sulphur. Ash, on dry basis shall not be more than 20%.

E. Herbicides: EPA registered and approved, of type recommended by manufacturer.

F. Water: Potable.

2.7 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

E. Natural Organic Fertilizer: Similar to Milorganite, produced by the Sewerage Commission, Milwaukee Wisconsin having the following analysis:

1. Total Nitrogen (6.5% water insoluble nitrogen) 6.0%
Available Phosphoric Acid 2.0%
Soluble Potash 0.0%
Iron (Fe) 3.0%

2.8 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Shredded hardwood bark for all plants. Fibrous texture and uniform dark brown color. Material shall be partially decomposed, of a consistency that not more than 25% will pass through a 1/2" sieve, 1 1/2" max. size with an organic content of not less than 90% and white wood content not exceeding 8%.

B. Straw mulch for lawns.

1. Provide straw mulch over new lawns per New York State Department of Transportation item 713-19. Provide air-dry, clean, mildew, and seed free, salt hay or threshold straw of wheat, rye, oats or barley.

C. Mulch, Binders, and Erosion Control Blankets for Lawn Areas

1. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination

and suitable for hydromulching. Acceptable products include Conwed Hydromulch, Conwed Corp., St. Paul, Minn., Cellin Hydromulch, Cellin Manufacturing, Inc., Lorton, VA. or approved equal.

2. Tackifier: Liquid concentrate diluted with water forming a transparent three-dimensional film-like crust permeable to water and containing no agents toxic to seed germination. Acceptable products include Polybind DLR, Celtite, Inc. Cleveland, Ohio; Curasol AK, American Hoechst Corp., Elk Grove, Illinois. or approved equal.

3. Erosion Control Blanket (slopes greater than 3:1) : Biodegradable made of curled wood excelsior with 80% six- inch fiber or greater. Material shall not contain any weed seed or chemical additives. Acceptable products include Curlex Single Net (Curlex 1), Green Color, as manufactured by American Excelsior Company, Arlington Texas or approved equal.

2.1 STAKES AND GUYS

A. Upright and Guy Stakes: Sound white cedar 3 to 3 1/2" inches in diameter by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized- steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

C. Hose Chafing Guard: Reinforced rubber hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.2 MISCELLANEOUS MATERIALS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions.

PART 3 – EXECUTION

3.1 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.2 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. Contractor shall have planting mix prepared prior to delivery to the site.

1. Install planting mix as shown on the drawings.

3.3 LAWN PLANTING PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture. Total topsoil depth shall be 4" for all Lawn Seed Mixes.

C. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.

2. Till surface soil to a depth of at least 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.

3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

D. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations. Seed bed shall be inspected by the Owner’s representative to ensure it has been properly compacted and fine graded prior to seeding, mulching and blanket installation.

E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 GROUND COVER, PLANT BED, AND PERENNIAL BED PREPARATION

A. Remove all existing soil to the required depth as shown on the drawings.

B. Install new planting mix to a depth as indicated on drawings.

3.5 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

1. Balled and Burlapped Trees and Shrubs: Excavate a minimum of 1 foot wider than the rootball diameter and equal to ball depth.

2. Container-Grown Trees and Shrubs: Excavate to a minimum of 1 foot wider than the container and equal to the container depth.

B. Obstructions: Notify the Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

3.6 PLANTING TREES AND SHRUBS

A. Planting Season: Plants shall be planted only within the following dates or as specified on the drawings. If special conditions exist which may warrant a variance in the planting dates, a written request shall be submitted to the Landscape Architect stating the special conditions and the proposed variance. Permission for the variance will be given if, in the opinion of the Landscape Architect, the variance is warranted.

1. Deciduous Trees and Shrubs: March 15 to May 31, and Sept. 15 to Nov. 15.

2. Evergreen Trees and Shrubs, Vines, Perennials: March 1 to May 15, and Sept. 1 to Nov. 1.

3. Ground Covers: March 1 to September 15.

B. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Place stock on setting layer of compacted planting soil.

2. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.

3. Place planting mix around ball in layers, tamping to settle backfill and eliminate voids

and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.

2. Place stock on setting layer of compacted planting soil.

3. Place planting mix around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

D. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

3.7 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by the Landscape Architect.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Landscape Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.8 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) and more than 3-inch (75-mm) caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

3.9 PLANTING GROUND COVER AND PLANTS

A. Space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.10 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 3 inches (50 mm).

3.11 SEEDING NEW LAWNS

A. Sow seed with a spreader, hydro seeder, or a seeding machine. Use spreader at all confined areas and as directed by Owner’s representative. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed at the following rates: Seeding Rate: 3 to 4 lb per 1000 sq. ft. (1.5 to 2 kg per 100 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

D. Install erosion control blankets on all slopes 3:1 or greater. Follow manufacturer’s installation instructions rigidly. Install mulch and binders compatible with hydro seeding operations.

3.12 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.14 SEED MIXTURE SCHEDULE

A. Seed Mix Type 'A': Provide certified grass-seed blends or mixes, proportioned by weight, as follows and meets the product requirements of NYSDOT specifications for "Lawn Seed Mix":

Proportion	Name
15 to 40 pct.	Poa Pratensis (Kentucky Bluegrass, 3 varieties minimum)
15 to 40 pct.	Lolium Perenne Perennial Ryegrass (2 varieties minimum- turf type)
5 to 15 pct.	Lolium Multiflorum Annual Ryegrass
30 to 50 pct.	Festuca rubra var. Fine Fescue (2 varieties minimum must include Creeping Fescue)

END OF SECTION 02900

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Flowable fill.

2. Concrete bases.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed 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.

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 323000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C150, Type I, portland.

2. Density: 115- to 145-lb/cu. ft. .

3. Aggregates: ASTM C33, natural sand, fine.

4. Admixture: ASTM C618, fly-ash mineral.

5. Water: Comply with ASTM C94/C94M.

6. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

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3.1 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 6 inches larger in both directions than supported unit.

2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3. Install anchor bolts to elevations required for proper attachment to supported equipment.

4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

5. Use, 28-day compressive-strength concrete and reinforcement as specified in Section 323000 "Cast-in-Place Concrete."

END OF SECTION 330500

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SECTION 331113 - FACILITY WATER DISTRIBUTION PIPING (SITE/CIVIL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water serviceandfire-service mains .

B. Water Utility shall furnished water meter to the site, ready for installation and perform tapping of existing water main.

1.3 DEFINITIONS

A. DIP: Ductile Iron Pipe.

1.4 ACTION 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.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 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.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping..

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping 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.

E. Protect stored piping from moisture and dirt. Elevate above grade.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.9 COORDINATION

A. Coordinate connections to water main with utility company. Utility Company shall perform tap of existing water main. Contractor shall provide equipment and manpower for excavation, backfill and restoration.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Application" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

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B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated. Class 54 Cement Lined.

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.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. Class 54 Cement Lined.

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.

2.3 SPECIAL PIPE FITTINGS

2.4 GATE VALVES

A. AWWA, Ductile Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Clow Valve Company; a subsidiary of McWane, Inc.

b. Mueller Co.

c. U.S. Pipe and Foundry Company.

2. 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.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

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A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Clow Valve Company; a subsidiary of McWane, Inc.

b. Mueller Co.

c. U.S. Pipe and Foundry Company.

2. 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,-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 51/4 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.

2.6 WATER METERS

A. Water meters will be furnished by utility company.

2.7 WATER METER BOXES

2.8 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for H-20 load designation according to ASTM C 857 and made according to ASTM C 858.

1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.

2. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.

a. Dimension: 24-inch- minimum diameter, unless otherwise indicated.

3. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.9 FIRE HYDRANTS

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A. Dry-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mueller Co.

2. Description: Freestanding, with one NPS 4-1/2 and two outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.

b. Pressure Rating:.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "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, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS3 to NPS8 shall be the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

F. Water Meter Box Water-Service Piping shall be same as underground water-service piping.

G. Underground Fire-Service-Main Piping shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed [**mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical**] [**grooved-end pipe; ductile-iron-pipe appurtenances; and grooved**] joints.

H. Underground Fire-Service-Main PipingNPS 6 to NPS 12 8 inch shall be any of the following:

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1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for 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,-seated gate valves with valve box.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" 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.

4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.

2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

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3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.

4. Install corporation valves into service-saddle assemblies.

5. Install manifold for multiple taps in water main.

6. 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.

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Bury piping with depth of cover over top at least, with top at least below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least cover over top.

2. In Loose Gravelly Soil and Rock: With at least additional cover.

H. Install piping by tunneling or jacking, or combination of both, under obstructions that cannot be disturbed.

I. Extend water-service piping within five (5) feet of outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping within five (5) feet of building wall. Terminate piping with caps, plugs, or flanges as required for piping material. Connections to building-water-piping systems by others, leave excess coiled tubing sufficient to reach meter when service is copper tubing.

J. 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 Section 330500 "Common Work Results for Utilities" 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.

3.7 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.

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2. Locking mechanical joints.

3. Bolted flanged joints.

4. 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. 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. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. 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.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 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, NSP 3 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.12 WATER METER BOX INSTALLATION

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A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.13 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.14 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.15 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-psigincrements and inspect each joint between increments. Hold at test pressure for 2 hours; decrease to0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage per WCHD regulations.

C. Prepare reports of testing activities.

3.16 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 Section 312000 "Earth Moving."

3.17 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 (NYSHD) 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.

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B. Prepare reports of purging and test results of disinfecting activities.

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SECTION 331313 - FACILITY SANITARY SEWERS (SITE/CIVIL)

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. PVC pipe and fittings.
2. PVC Pressure Pipe and fittings
3. PVC pipe sleeve.
4. Nonpressure-type transition couplings.
5. Pressure-type pipe couplings.
6. Cleanouts.
7. Concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pipe and fittings.
2. Pressure couplings
3. Cleanouts.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting.

B. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 FIELD CONDITIONS

PART 2 - PRODUCTS

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2.1 PVC PIPE AND FITTINGS

A. PVC SDR-35 Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

B. PVC SDR-26 Pressure Piping:

1. Pipe: AWWA C900, PVC pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: AWWA C900, PVC pipe with bell ends.

3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Schedule 80 Pipe Sleeve:

1. Pipe: ASTM D 1785, PVC, with plain ends for solvent-cemented joints.

2. Fittings: PVC, socket type.

2.2 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Gasket Material: Natural or synthetic rubber.

C. Metal Component Finish: Corrosion-resistant coating or material.

2.3 CLEANOUTS

A. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

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and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, sewer piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of percent unless otherwise indicated.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

3. Install piping with 48-inch minimum cover.

4. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

2. Install piping with 48-inch minimum cover.

3. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

2. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:

1. Join PVC pressure piping according to AWWA M23 for gasketed joints.

2. Join dissimilar pipe materials with pressure-type couplings.

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C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. flexible or rigidcouplings for pipes of same or slightly different OD.

b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC SDR-35 pipe fittings in sewer pipes at branches for cleanouts, and use PVC SDR-35 pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow sewer piping to within 5 feet of building foundation wall.

B. Connect force-main piping between sanitary pump station and Splitter Box.

C. Connect to septic tank specified in Section 221323 "Sanitary Waste Interceptors."

3.6 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over nonferrous piping.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

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a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Fill sewer piping with water. Test with pressure of at least 10-foothead of water, and maintain such pressure without leakage for at least 2 hours.

b. Close openings in system and fill with water.

c. Purge air and refill with water.

d. Disconnect water supply.

e. Test and inspect joints for leaks.

6. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than.

a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance".

C. Leaks and loss in test pressure constitute defects that must be repaired.

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D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

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SECTION 331343 - FACILITY SEWAGE PUMPING STATIONS (SITE/CIVIL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes wet-well, pumping stations with submersible sewage pumps, controls and alarm.

1.3 PERFORMANCE REQUIREMENTS

A. Pressure Rating of Sewage Pumps and Discharge Piping Components: At least equal to sewage pump discharge pressure, but not less than .160 psi

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Show fabrication and installation details for sewage pumping station. Detail equipment assemblies and indicate dimensions; ; components; electrical characteristics; controls, alarms and location and size of each connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For .

B. Source quality-control test reports.

C. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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B. Comply with HI 1.1-1.2, "Centrifugal Pumps for Nomenclature and Definitions"; HI 1.3, "Centrifugal Pumps for Design and Application"; and HI 1.4, "Centrifugal Pumps for Installation, Operation and Maintenance," for sewage pumps.

C. Comply with UL 778, "Motor-Operated Water Pumps," for sewage pumps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sewage pumping stations that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of sewage pumps, controls, or accessories.

2. Warranty Period for Sewage Pumps and Controls: one (1) year from date of Substantial Completion.

3. Warranty Period for Accessories: one (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEWAGE PUMPING TANK

A. Sewage Pumping Tank with Submersible Sewage Pumps:

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. Goulds PumpsTwo (2) Model 3887/.33 hp / 115 volts / Single Phase.

2. Precast Reinforced Concrete 1,000 gallon Pump Chamber.

a. Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than in diameter.

b. Sewage Pumps: submersible-type sewage pumps, with guide rail, quick-disconnect system, controls, and piping. Include ASTM A 48/A 48M, Class 25, nonclog, cast-iron impeller capable of passing solids of minimum diameter; and hermetically sealed motor with moisture-sensing probe, mechanical seals, and waterproof power cable.

3. Capacities and Characteristics: See Contract Plans

a. Each Sewage Pump:

1) Capacity: 50 gpm

2) Total Dynamic Head: 13

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3) Speed: 1750

4) Impeller:

a) Diameter: 5.38inches

b) Solids Size Design: 3/4inches

5) Discharge Size: Three (3) inch diameter.

6) Motor Size: 0.33 hp.

7) Electrical Characteristics:

a) Volts: V.

b) Phases:.

c) Hertz: 60.

2.2 CONTROLS

A. Control Sequence of Operation: Cycle each sewage pump on and off automatically to maintain wet-well sewage level. Automatic control operates both pumps in parallel if wet-well level rises above starting point of low-level pump, until shutoff level is reached. Automatic alternator, with manual disconnect switch, changes sequence of lead-lag sewage pumps at completion of each pumping cycle.

B. Float-Switch System: Senses variations of sewage level in wet well. Include high and low adjustments capable of operating on minimum differential of liquid level.

C. Motor Controllers: Magnetic, full voltage, nonreversing. Include undervoltage release, thermal-overload heaters in each phase, manual reset buttons, and hand-automatic selector switches. Include circuit breakers to provide branch-circuit protection for each controller.

D. 120-V accessory controls with 15-A, single-phase circuit breakers or fuses for each item.

E. Control Panel: Goulds AWA 501 Single Phase Alternator Panel. Enclosure complying with UL 508A and with UL 508A, Supplement SB with separate compartments and covers for controllers, circuit breakers, transformers, alternators, and single-phase controls. Include 20-A duplex receptacle in NEMA WD 1, Configuration 5-20R mounted on exterior of control panel.

1. Mounting: Inside Building Mechanical Room .

2. Enclosure: NEMA 250, Type 4 .

F. Install labels on panel face to identify switches and controls.

G. Wiring: Tin-copper wiring.

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H. Connection for Emergency use of pumps from Generator: Automatic transfer switch with receptacle matching generator electrical power requirements.

2.3 ACCESSORIES

A. High-Water Audio and Visual Alarm: Goulds CentriPro Tan 4m 4x. Horn for audio indication of station high-water level, energized by separate level-detecting device. Include alarm silencer switch and relay at controls. Alarm activation at High Water Level.

B. Remote Alarm Circuit: Include contacts for connection to remote alarm panel.

2.4 SEWAGE PUMPING STATION

A. Precast reinforced concrete tank.

1. Attach air vent to pump chamber.

B. Entrance Cover: 24 inch diameter opening minimum with Campbell Foundry Waterproof/ Locking Frame and Grate Model # 1734.

C. Air Vent: Duct fabricated from corrosion-resistant material, extended to above grade, outlet turned down, and with insect screen in outlet.

D. Piping Connections: Unless otherwise indicated, make the following piping connections:

1. Install unions, in piping NPS 3 and smaller, adjacent to each valve and at final connection to each piece of equipment having NPS 3 or smaller threaded pipe connection.

E. Valves:

1. Sewage Pump Piping: Include Ball valve and Check valves on each discharge pipe.

F. Wiring: Tin-coated copper.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect sewage pumps according to HI 1.6, "Centrifugal Pump Tests." Include test recordings that substantiate correct performance of pumps at design head, capacity, suction lift, speed, and horsepower.

B. Test accessories and controls through complete cycle. Include test recordings that substantiate correct performance.

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.

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B. Examine roughing-in of sewerage piping systems to verify actual locations of piping connections before sewage pumping station installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.3 INSTALLATION

A. Install sewage pumping station components where indicated, according to specific equipment and piping arrangement indicated on Contract Plans.

3.4 CONNECTIONS

A. Sanitary sewer piping installation requirements are specified in Section 331313 "Facility Sanitary Sewers." Drawings indicate arrangement of piping.

3.5 PAINTING

A. Prepare and paint ferrous piping in wet wells, structural-steel supports, and anchor devices with coal-tar epoxy-polyamide paint according to SSPC-Paint 16.

B. Paint field-welded areas to match factory coating.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform field tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing sewage pumping stations and after electrical circuitry has been energized, test for compliance with requirements. Furnish water required for pump tests.

2. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Repair sewage pumping stations that do not pass tests and inspections and retest as specified above.

3.7 STARTUP SERVICE

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A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Adjust pump, accessory, and control settings, and safety and alarm devices.

3.8 DEMONSTRATION

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

END OF SECTION 331343

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SECTION 331353 - FACILITY SEPTIC SYSTEM (SITE/CIVIL)

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. Septic tank.
2. Pump tank.
3. Distribution boxes.
4. Pipe and fittings.
5. Absorption systems.

1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components, and profiles.
2. Include manhole openings, covers, and pipe connections.

B. Shop Drawings: For trench absorption systems .

1. Include manhole openings, covers, pipe connections, and accessories.
2. Include piping with sizes and invert elevations.
3. Include underground structures.
4. Include other utilities.

PART 2 - PRODUCTS

2.1 CONCRETE SEPTIC TANKS

A. Description: ASTM C 1227, precast, reinforced-concrete tank and covers;.

B. Design: For traffic loading according to ASTM C 890.

C. Manholes: minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.

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D. Inlet and Outlet Access: minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.

E. Resilient Connectors: ASTM C 923, of size required for piping, fitted into inlet and outlet openings.

F. Capacity and Characteristics:

1. Capacity: 4,000 gallons .

2. Inlet and Outlet Size: 4" .

2.2 Pump Chamber

A. Description: Comply with ASTM C 858 for precast, reinforced-concrete tank and cover; designed for structural loading according to ASTM C 890.

B. Design: For effluent pump installation and traffic loading according to ASTM C 890.

C. Manholes: minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.

D. Capacity and Characteristics:

1. Capacity: 1,000 gallon .

2. Inlet and Outlet Size:.

2.3 CONCRETE DISTRIBUTION BOX and Splitter Box

A. Description: Precast concrete, single-chamber box and cover.

B. Design: Made according to ASTM C 913, and for traffic loading according to ASTM C 890. Include baffle opposite inlet.

C. Manholes: minimum diameter opening with reinforced-concrete risers to grade and cover with steel lift rings in center of distribution box cover.

D. Resilient Connectors: ASTM C 923, of size required for piping, fitted into inlet and outlet openings. Include watertight plugs in outlets not required. Include Speed Levelers within Distribution Box.

2.4 PVC Schedule 20 Belled and Perforated DISTRIBUTION PIPE AND FITTINGS

A. Pipe and Fittings: ASTM D 2729, perforated, for solvent-cemented joints.

B. Solvent Cement: ASTM D 2564. Include primer according to ASTM F 656.

2.5 TRENCH ABSORPTION-SYSTEM MATERIALS

A. Filter Material: ASTM D 448, Size No. 24, 3/4 to 1-1/2 inches, washed, crushed stone or gravel; free of fines and silt.

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B. Filter Mat:.

C. Fill Material: Backfill with Soil removed from trench. Imported soil over system to be Run of Bank meeting Westchester County Health Department Regulations.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling for piping are specified in Section 312000 "Earth Moving."

1. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.

2. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Excavating and Backfilling for Septic Tanks:

1. Excavate sufficient width and length for tanks to depth determined by tank inlet elevation. Provide level bottom.

2. Backfill with excavated soil.

C. Excavating and Backfilling for Trench Absorption Systems:

1. Excavate for trench absorption systems wide and deep, minimum.

2. Backfill with excavated soil, mounding soil above original grade without compacting.

3.2 SEPTIC TANK INSTALLATION

A. Install precast concrete septic tanks according to ASTM C 891.

B. Install septic tanks level and to elevations specified on Contract Plans.

C. Install Septic Tank on 3 inch bed of sand or pea gravel.

3.3 PUMP CHAMBER INSTALLATION

A. Install pump chamber according to ASTM C 891.

B. Install pump chamber level.

C. Set submersible effluent pumps on pump chamber floor. Make direct connections to force main piping. Comply with requirements for effluent pumps specified in Section 331343 " Sewerage Pump Stations."

D. Install pump chamber on 3 inch bed of sand or pea gravel.

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3.4 DISTRIBUTION BOX INSTALLATION

A. Install precast-concrete distribution and splitter boxes according to ASTM C 891 and at invert elevations indicated on Contract Plans. Set level and plumb on 12 inch minimum bed of pea gravel which extends to a minimum depth of 42 inches below finished grade.

3.5 PIPING INSTALLATION

A. Comply with requirements for sewer pipe installation specified in Section 331313 "Facility Sanitary Sewers."

B. Install distribution piping according to the following:

1. Use perforated pipe and fittings for absorption systems with perforations at bottom.

2. PVC Sewer Pipe and Fittings: ASTM F 481.

3.6 PIPE JOINT CONSTRUCTION

A. Join distribution piping with or according to the following:

1. Install pipe and fittings for absorption systems with closed joints unless otherwise indicated.

2. PVC Sewer Pipe and Fittings: With solvent-cemented joints according to ASTM F 402 and ASTM D 2321.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts according to the following:

1. At Each Change in Direction of Sewer Piping: PVCcleanouts. and as specified within Contract Plans.

B. Comply with requirements for cleanouts specified in Section 331313 "Facility Sanitary Sewers."

C. PVC Cleanouts: Install with PVC riser from sewer and distribution piping to PVC cleanout at grade. Use NPS 4 PVC sewer pipe and fittings with solvent-cemented joints for risers and cleanout fitting.

D. Cleanout Support: Set cleanouts in concrete blocks deep unless location is in concrete pavement. Formwork, reinforcement, and concrete are specified in Section 323000 "Cast-in-Place Concrete."

E. Set top of cleanout above surrounding rough grade, or set flush with grade if installed in pavement.

3.8 TRENCH ABSORPTION-SYSTEM INSTALLATION

A. Filter Material: Place supporting layer of filter material over the compacted base to a compacted depth not less than 6 inches below bottom of pipe.

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B. Install sewer piping.

C. Install distribution piping solidly bedded in filter material, with full bearing for each pipe section throughout its length. Maintain pipe alignment and slope.

1. Install perforated pipe with perforations down and joints tightly closed. Install couplings as required.

2. Install elbow fittings with tight joints.

3. Install absorption-system materials as follows from surface of excavation to grade:

a. Trench Size: long.

b. Bed Size: wide with distribution piping long.

c. Bottom Filter Material Layer: thick below distribution piping.

d. Intermediate Filter Material Layer: OD of distribution piping.

e. Top Filter Material Layer: minimum thickness above distribution piping.

f. Filter Mat: Above final filter-material layer.

g. Fill: Above filter mat to final grade.

D. Install filter mat over filter material before backfilling.

3.9 IDENTIFICATION

A. Identification materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green, detectable warning tape directly over piping, at outside edges of underground structures.

3.10 FIELD QUALITY CONTROL

A. System Tests: Perform testing of completed septic tank system piping and structures according to authorities having jurisdiction.

B. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.

3.11 CLEANING

A. Clear interior of piping and structures of dirt and other superfluous material as work progresses.

B. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of workday or when work stops.

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SECTION 331413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. PVC pipe and fittings, between building and site drainage system.

B. Related Requirements:

1. Section 334400 "Stormwater Utility Equipment" for storm drainage piping outside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water .

2.2 FITTINGS: Downspout Boot

A. Manufacturers: Subject to compliance with requirements, :

1. Jay R. Smith MFG Co. .

2.3 PVC SDR-35 PIPE AND FITTINGS

A. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

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B. Solid-Wall PVC Pipe: ASTM D 2665; bell and gasket sewer pipe.

C. Downspout Boot: Jay R Smith Cast Iron Boot 1786 Series

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping at indicated slopes.

C. Install piping free of sags and bends.

D. Install fittings for changes in direction and branch connections.

E. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.

2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3. Maintain swab in piping and pull past each joint as completed.

G. Install piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: percent downward in direction of flow for piping NPS 3 and smaller; percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Storm Drainage Piping: percent downward in direction of flow.

H. Install underground piping according to ASTM D 2321.

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3.3 JOINT CONSTRUCTION

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect storm drainage piping to roof drains with cast iron downspout boot.

3.5 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.

B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test Procedure:

a. Test storm drainage piping on completion of roughing-in.

b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

2. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

C. Piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

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.

3.7 PIPING SCHEDULE

A. Underground, storm drainage piping shall be [**any of**] the following:

1. Solid-wall PVC pipe, PVC Bell and gasket.

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SECTION 334200 - STORMWATER CONVEYANCE

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. HDPE pipe and fittings.
2. PVC pipe and fittings.
3. Cleanouts.
4. Drains Inlets.
5. Catch basins.
6. Stormwater detention system.
7. Stormwater Treatment Systems.
8. Pipe outlets.

1.3 DEFINITIONS

A. HDPE: High Density Polyethylene.

B. PVC: Polyvinyl Chloride

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. . Include plans, elevations, sections, details, frames, covers, and grates.
2. Stormwater Detention Structures: Include plan view, elevations, sections.
3. Frame and Covers and Grates: Include plan view, elevation and sections.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting, from manufacturer.

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1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

1.8 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 CORRUGATED Dual Wall-HDPE N-12 PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated dual wall-HDPE N-12 pipe and fittings from single manufacturer.

B. Corrugated-HDPE Pipe and Fittings N 12 to N 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

C. Corrugated-HDPE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.2 PVC SDR-35 PIPE AND FITTINGS

A. Source Limitations: Obtain PVC SDR-35 pipe and fittings from single manufacturer.

B. Bell and spigot ends for gasketed joints ASTM 3034 and ASTM 1477.

C. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

D. PVC Ring-Tite Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F679, wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

2.3 CLEANOUTS

A. PVC Cleanouts:

1. Source Limitations: Obtain PVC cleanouts from single manufacturer.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Cast Iron valve box with cover.

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2.4 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

5. Joint Sealant: ASTM C990, bitumen or butyl rubber.

6. Steps: Individual FRP steps or FRP ladder , wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.

7. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate as specified on Contract Plans.

1. Size: minimum unless otherwise indicated.

2.5 STORMWATER INLETS

A. Inlets: . Include heavy-duty frames and grates as specified on Contract Plans.

B. Frames and Grates: Heavy duty.

2.6 STORMWATER DETENTION SYSTEM

A. Subsurface HDPE drain pipe system to store stormwater runoff.

1. Grade Rings: Include two or three reinforced-concrete rings, of total thickness, that match diameter frame and cover.

2. N-12 HDPE dual wall water tight (WT) manifolds and appurtenances.

2.7 PIPE OUTLETS

A. Head Walls: Stone masonry or precast concrete, as specified on Contract Plans.

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B. Riprap Basins: Broken, irregularly sized and shaped, graded stone in accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-5, screen opening 5 inches.

C. Filter Stone: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

2.8 STORMWATER TREATMENT SYSTEMS

A. Oil / Water Separator 6,000 gallon Precast reinforced concrete tank by Oldcastle Precast

B. R Tank Stormwater Treatment System:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ACF Environmental.

2. Source Limitations: Obtain chamber systems from single manufacturer.

3. Storage and Leaching Module : R Tank HD Model 3.5.

4. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.

5. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd..

C. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252 for and smaller, AASHTO M 294 for . Include proprietary fittings, couplings, seals, and filter fabric.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Cultec Inc.

2. Source Limitations: Obtain rechargers from single manufacturer.

3. Cultec 330 XL Recharger

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

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3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. All drainage pipe shall be HDPE N-12 Dual Wall Corrugated Pipe, except roof leader drain pipe which shall be PVC SDR-35 pipe and fittings.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

G. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.

2. Install piping with inch- minimum cover.

3. Install HDPE corrugated piping in accordance with ASTM D2321.

4. Install PVC SDR-35 piping in accordance with ASTM D2321 and ASTM F1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join corrugated-HDPE piping in accordance with ASTM D3212 for silt tight joints.

2. Join PVC SDR-35 gravity piping in accordance with ASTM D2321 for bell and spigot ends for gasketed joints.

3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from drain pipes to cleanouts at grade. Use PVC SDR-35 pipe fittings and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

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1. Use Heavy-Duty, top-loading classification cleanouts in areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch(es) above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INLET INSTALLATION

A. Install type of drains in locations indicated.

1. Use Heavy-Duty, top-loading classification drains.

B. Set drain frames and covers with tops flush with pavement surface.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET INSTALLATION

A. Construct head walls of stone masonry, as indicated.

B. Construct riprap apron of stone natural to the area, as indicated.

C. Construct energy dissipaters at outlet aprons, as indicated.

3.8 STORMWATER TREATMENT SYSTEMS INSTALLATION

A. In accordance with manufacturers written instructions.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, in accordance with piping manufacturer's written instructions.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping from building drains to site drainage system.

B. Connect to oil and water separator within driveway.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8- inch- thick, brick masonry bulkheads.

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2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

C. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.11 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.

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3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.

   b. Option: Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334200

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SECTION 334600 - SUBDRAINAGE

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. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Drainage conduits, including rated capacities.
2. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PVC SDR-35 Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.2 SOIL MATERIALS

A. Soil materials are specified in Section 312000 "Earth Moving."

2.3 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2 .
2. Styles: Flat and sock.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.3 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 6 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inchesson sides and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping with drainage course to width of at least6 inchesson sides and above top of pipe to within12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

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3.4 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping with a minimum cover of 24 inches unless otherwise indicated.
2. Lay perforated pipe with perforations down.
3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

3.5 PIPE JOINT CONSTRUCTION

A. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."

B. Cleanouts for Retaining-Wall Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. Comply with requirements for concrete specified in Section 323000 "Cast-in-Place Concrete."

3.7 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

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3.8 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312000 "Earth Moving."

1. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.9 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

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